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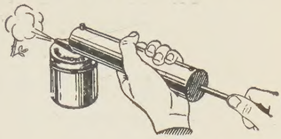

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Pappenheim (E.). **Beitrag zur Kenntnis der Oberflächenstruktur von Motteneiern.** [A Contribution to the Knowledge of the Surface Structure of the Eggs of Moths.]—*Z. hyg. Zool.* **30** pt. 7–8 pp. 240–243, 9 figs. Berlin, 1938.

Descriptions and figures are given of the surface structure of the eggs of *Borkhausenia pseudospretella*, Staint., *Tinea pellionella*, L., *T. fuscipunctella*, Haw., *T. columbariella*, Wck., and *Endrosis lacteella*, Schiffm. The characters are of value for differentiating the species.

Caresche (L.). **Note préliminaire sur le borer du caféier au Phu-qui (Annam). Étude écologique et incidence sur l'économie des plantations.**—*Bull. écon. Indochine* **41** fasc. 4 pp. 836–850, 2 pls., 2 graphs, 2 refs. Hanoi, 1938.

This is a study of the incidence of *Xylotrechus quadripes*, Chevr., on coffee at Phu-qui in Annam. Damage by other insect pests is of little significance, but this Cerambycid causes an annual loss of about 7 per cent. of the crop. The larvae infest the roots to a depth of about 7 inches below the surface of the soil, and often also attack the stems to a height of 2–3 feet. The investigations were carried out on two sections, of approximately 300 and 280 acres, in one plantation. Details are given of fertilisers applied to sub-sections, and graphs show the numbers of beetles caught at approximately 10-day intervals during 1935, 1936 and 1937, the degree of infestation, and the monthly rainfall and temperature. The greatest numbers of beetles emerge in May, June and July, when the temperature is highest, but smaller numbers also appear in February–March and November–December. Larvae produced by the beetles emerging in the spring cause maximum injury, which is evident from May to July when, owing to drought, the coffee bushes are particularly susceptible. The prevalence of the adults from May to July is not reflected in the severity of damage in August and September, although this is considerable.

The resistance of the bushes is increased by fertilisers, and they appear to be more vigorous where shade-trees are grown. The beetles are probably less inclined to oviposit in the shade. Methods recommended for control include the cutting back of infested branches and the destruction of bushes with seriously affected roots. *Aleurites montana* is probably the most suitable shade-tree, as its root-system appears to be at a much deeper level than that of coffee, and it loses its leaves during the winter when the coffee bushes need additional light. Fertilisers should be applied at the beginning of the winter. Cultural methods should, so far as possible, be directed towards the conservation of water in the soil.

Annual Report of the Cotton Experiment Station, Klongtan, Swankaloke, Siam. B.E. 2479 (1936–7). Vol. I.—52 pp. Bangkok, Dep. Agric. Fish. Siam, August, B.E. 2480 [1938].

Sections of this report (pp. 8–9 and 38–40) deal with observations on cotton pests in Siam in 1936–37 ; none of them caused any severe injury. About mid-September *Pempheres affinis*, Fst., was found attacking 31 per cent. of the plants on some plots, and *Sylepta derogata*, F., 21 per cent., but they were both well under control by early October. Of sucking insects, Jassids were the most common and seemed to prefer the American, and later the Egyptian varieties ;

they appeared in the second week of September, but were controlled until October by the use of light-traps. *Platyedra gossypiella*, Saund., and *Earias fabia*, Stoll, affected nearly all of the plants, but only did slight damage. Tables show the maximum, minimum and average periods required for development of the various stages of *P. gossypiella*, *S. derogata*, *Cosmophila* (*Anomis*) *flava*, F., and *Dysdercus cingulatus*, F., and the numbers of eggs laid by females of the last two.

KUROSAWA (M.). **A Quarantine Interception of a new** *Phloeothrips* **from Japanese South Sea Islands.**—*Zool. Mag.* **49** no. 9 pp. 316–318, 2 figs. Tokyo, September 1937.

Descriptions are given of the macropterous male and female of *Phloeothrips kinugasai*, sp. n., which was intercepted at Yokohama on orange fruits from Yap Island and coconut leaves from Saipan.

KUROSAWA (M.). **A new Species of** *Trichothrips* **injuring Lily Bulbs in Japan and Korea.**—*Zool. Mag.* **50** no. 3 pp. 154–156. Tokyo, March 1938.

Brief descriptions are given of the macropterous male and female of *Hoplothrips* (*Trichothrips*) *liliorus*, sp. n., which has been recorded in Japan and Korea together with *Liothrips vaneeckei*, Priesn., on lily bulbs.

DIAKONOFF (A.). **Indo-Malayan and Papuan Microlepidoptera. 1. Notes on the Tropical Tobacco Moth,** *Setomorpha rutella* **Zeller (Tineidae).**—*Treubia* **16** pt. 3 pp. 399–414, 10 figs., many refs. Buitenzorg, 1938.

A Tineid of the genus *Setomorpha*, injurious to cured tobacco leaves in the Netherlands Indies, has been recorded there under the names of *rutella*, Zell., *corticinella*, Sn., *margalaestriata*, Keuch. [**6** 223, 349; **7** 251, 286; **8** 330; **9** 366, 508; **10** 108; **17** 473] and *insectella*, F. The author has examined type material of all these species, particularly the male genitalia, and finds that *Tinea insectella* is a synonym of *T. misella*, Zell., a moth common in animal and vegetable material and having a European distribution. The correct name for the Tineid in the Netherlands Indies is *S. rutella*, of which the other two are synonyms. The genus *Setomorpha* and the male of *S. rutella*, Zell., are described, the latter with special reference to the genital characters, and 124 references are given to works in which mention is made of this Tineid under one of the 17 names under which it has at various times been recorded. *S. rutella* is polyphagous, having been found in a great number of animal and vegetable materials. It was very injurious in Sumatra and Java during the Great War, when large quantities of dried tobacco were stored in the Netherlands Indies, but fumigation and the renewal of export reduced its incidence to occasional returns. Its distribution according to available records is shown, with the breeding places where possible.

PRUTHI (H. S.). **The Distribution, Status and Biology of Codling Moth (*Cydia pomonella*, L.) in Baluchistan with Notes on some other Insects infesting Apples.**—*Indian J. agric. Sci.* **8** pt. 4 pp. 499–547, 1 fig., 6 pls., 1 map, 14 refs. Delhi, August 1938.

From May to November 1937, a survey of the fruit-growing regions of Baluchistan was carried out to ascertain the status and distribution of *Cydia pomonella*, L. [*R.A.E.*, A **24** 72] and other Lepidoptera infesting apples. All stages of the different species are described. The adults of the overwintered generation of *C. pomonella* emerge for about four weeks from mid-April, when the apple and pear trees are in bloom. There are two generations annually, the number of larvae in the second being much smaller than in the first. Both apples and pears were severely attacked, 50–85 per cent. of the former being infested in all but one of the localities in which the moth was found, while infestation of quinces was as high as 90 per cent. in one place in which they are cultivated on a large scale. The infestations recorded were all in districts 4,500–6,000 ft. above sea level, and appeared to be heaviest where the mountain ranges were close to one another, whereas the more open country of one district of almost the same altitude as Quetta was entirely free from attack. Appendices show the temperature and humidity in several localities, the percentage infestation by *C. pomonella* of different varieties of apple, the numbers of larvae inside damaged fruit at various times of the year, and the durations of the stages under different conditions of temperature and humidity.

Eucosma (*Spilonota*) *ocellana*, Schiff., was found on apples and quinces in several localities. It has one generation a year, the moths occurring in May–July. The larvae feed till September, overwinter in hibernacula of tightly woven silk in the angles of twigs or near the leaf or flower buds, and resume feeding in April. They always feed under cover, sheltered by tubes of silk. They attack the leaves, which they spin together, and cause scars on the fruits when these are in contact with leaves or with one another, and in spring they bore into the developing buds. Pupation occurs in a cocoon concealed among the webbed leaves. Under laboratory conditions the durations of the incubation, prepupal, pupal and pre-oviposition periods were, respectively, 8–11, 3, 9–13, and 3–4 days. The adults lived 1–2 weeks in captivity. Near Quetta 10–30 per cent. of the fruits of apples and quinces showed evidence of injury by the larvae, which were also found in small numbers attacking the leaves of cherry.

The Pyralid, *Euzophera punicaeella*, Moore, was recorded from apple for the first time ; in 1890 it was reared from pomegranates grown in Baluchistan. It was nearly always found in apples already damaged by *C. pomonella*, and though the larvae were able to burrow into and develop in sound fruit, they flourished best in infested apples. Pupation takes place in a delicate cocoon, usually inside the fruit. The eggs hatched in about 5 days at 75°F. and 7–8 at 68°F. The larval and pupal stages last 3–4 weeks and 5–7 days, respectively. The larvae were heavily parasitised by a Tachinid and a Braconid.

Tortrix (*Cacoecia*) *sarcostega*, Meyr., was common in several districts and very abundant on apple in one locality. Ripe fruits of apricots, peaches, nectarines and some varieties of plums are also attacked. When a larva attacks a leaf, it severs the petiole and spins the leaf to the surface of another or to a fruit. It lives inside this shelter and feeds on the soft tissue between the veins or on the outer skin of the fruit. It does not burrow into sound fruits, but enters apples already damaged by larvae of *C. pomonella*. Pupation takes place in an elongated cocoon inside the larval shelter. The durations of the incubation, pupal and pre-oviposition periods were, respectively, 8–10, 9–12, and 2–5 days. There are three generations during the summer. At the end of October, the partly grown larvae make small hibernacula similar to those of *E. ocellana,* in which they overwinter.

STANLEY (J.) & SMALLMAN (B. N.). **A Method of determining the mean Speed of Movement of Insects in a mass of Flour.**—*Canad. J. Res.* (D) **16** no. 8 pp. 221–224, 1 fig., 3 refs. Ottawa, August 1938.

The following is substantially the authors' abstract : A method is described of determining the mean speed of movement of adults of *Tribolium confusum,* Duv., through a mass of flour. It consists of allowing a beetle to wander for a suitable period through a mass of alternate black and white layers of flour, each 1 mm. thick. The motion of the beetle's legs churns the two colours into one another as it tunnels through the flour. If the mass of flour is compressed into a solid cake, and sectioned at right angles to the laminae, the course of the tunnel is marked by grey traces owing to this mixing. From a study of these traces in section, the trail may be reconstructed and the distance traversed in unit time computed.

FREAR (D. E. H.) & WORTHLEY (H. N.). **Deposition and Retention of Sprays on Apples.**—*Bull. Pa agric. Exp. Sta.* no. 344, 32 pp., 8 figs., 19 refs. State College, Pa, April 1937.

The following is based on the authors' abstracts of attempts in Pennsylvania in 1934 and 1935 to increase the effectiveness of lead arsenate in cover sprays against first-generation larvae of *Cydia* (*Carpocapsa*) *pomonella,* L., on apple : In 1934, six applications of cover sprays were made ; they consisted of 3 lb. lead arsenate per 100 U.S. gals. with the addition of 2 U.S. gals. liquid lime-sulphur, with and without 2 lb. skim-milk powder, or of 5 lb. dry flotation sulphur and 1 quart menhaden fish oil. Samples of leaves and fruits were taken from the lower branches. The losses of spray deposits per unit area of fruit surface were almost entirely due to growth. The foliage had attained 97 per cent. of its full size and the fruits 7 and 12 per cent. at the time of the second, third and sixth cover sprays, respectively. The spray with lime-sulphur and no milk gave the greatest spray deposits on the fruits, and that with fish oil on the leaves. The latter spray gave the smallest losses between and after the sprayings on both leaves and fruits ; deposits on the fruits were less than 1·5 times as great after the sixth as after the first cover spray. This spray was applied in three different schedules in 1935, and fruit samples were taken from both upper and lower branches. The top fruits grew more rapidly and showed larger losses of deposit per unit area than the lower ones. When the spray was applied three times at intervals of 14 days, early season coverage was poor ; when it was applied six times at intervals of a week, the second, fourth and sixth applications being directed to the tops of the trees only, the spray deposits at the end of the period were considerably in excess of the amount considered necessary for protection ; and when it was applied four times at intervals of 4, 10 and 20 days (these intervals representing the periods required for the doubling of the surface area of the fruits), the coating became deficient during the 20-day interval between the last two applications. It is concluded that a schedule of 5 cover sprays at intervals of 5, 9, 13 and 17 days, the last to be applied to the tops only, should be tested under conditions of heavy attack before recommendations can be made.

MADER (E. O.) & BLODGETT (F. M.). **Effects of Bordeaux Mixture and Pyrethrum Dust on Leafhopper Control and Yields of Potatoes.**—*Amer. Potato J.* **15** no. 1 pp. 10–15, 3 refs. Somerville, N.J., January 1938.

Previous experiments in New York [*R.A.E.*, A **23** 556] had indicated that the application of copper sulphate in the form of Bordeaux mixture at the rate of 75–80 lb. per acre during the season increased the yield of potatoes to a greater extent than could be explained by the fact that it controlled the potato leafhopper [*Empoasca fabae*, Harr.]. In experiments in 1935 to obtain fuller information on this point, pyrethrum dust was applied to sections of plots sprayed with various concentrations of Bordeaux mixture. The average weights of leaves and tubers increased with the application of increasing amounts of copper sulphate, whether or not pyrethrum was also applied, and since the mortality of the nymphs obtained by dusting was about equal in plots receiving from 0 to 144 lb. copper sulphate per acre during the season, the increased yields could not have been due to leafhopper control. On the other hand, Bordeaux mixture giving 48 lb. copper sulphate per acre resulted in 95 per cent. control of the leafhopper, so that few additional insects were killed by the pyrethrum in plots where sufficient Bordeaux was applied. In spite of this, there were in general fairly consistent gains in foliage and tuber weights for all dusted plots, indicating that the growth of the plants was stimulated by the pyrethrum, independently of its insecticidal action [*cf.* **25** 318].

MIDDLETON (W.). **A Sawfly injurious to young Pines.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1259 revd, 6 pp., 9 figs. Washington, D.C., June 1938.

In this revision of a previous bulletin [*R.A.E.*, A **10** 598], the information in which was noticed from another source [**9** 266], it is stated that *Diprion* (*Neodiprion*) *lecontei*, Fitch, occurs throughout the eastern part of the United States and Canada and there is some evidence that it also occurs in Missouri and Arkansas. *Pinus rigida*, *P. echinata*, and *P. caribaea* are added to the list of trees attacked, and it is recommended that ½ U.S. pt. of either fish oil or linseed oil be used as an adhesive in the spray of 2 lb. lead arsenate in 50 U.S. gals. water [**9** 267].

JOHNSON (A. C.), BECKER (G. G.) & HAWKINS (L. A.). **Fumigation of baled Cotton with Hydrocyanic Acid for the Pink Bollworm.**—*Tech. Bull. U.S. Dep. Agric.* no. 623, 45 pp., 9 figs., 5 refs. Washington, D.C., August 1938.

The following are substantially the authors' summary and conclusions : Experimental apparatus was developed for the study of the fumigation of baled cotton for the pink bollworm [*Platyedra gossypiella*, Saund.] at pressures below that of the normal atmosphere, and many experiments were carried on in commercial fumigation chambers in Texas. Two systems were compared in many of the experiments—low-pressure fumigation, at about the equivalent of 2 inches of mercury, and high-pressure fumigation, in which the pressure was raised to 20 or 25 inches, as measured from an absolute vacuum, after the fumigant had been admitted.

If a bale of cotton was in the fumigation chamber and the air was exhausted, the air pressure within the bale fell uniformly with the pressure in the space round it. If the fumigating gas (hydrocyanic acid) was then introduced, the pressure in both the centre of the bale and in the space round it rose simultaneously. Under low-pressure fumigation, the concentration of HCN in the centre of the bale continued to increase for 90–105 minutes, owing to the diffusion of the fumigant into the bale. The diffusion was more rapid when the concentration outside the bale was high. The concentration of the fumigant could be increased either by increasing the quantity of HCN or by decreasing the quantity of air. Therefore, the lower the air pressure on the introduction of the fumigant (no further introduction of air being allowed), the higher the concentration within the bale in a given time. The low-pressure system consistently gave much higher concentrations of the fumigant in the centres of the test bales. The dosage of HCN per 100 cu. ft. of chamber space, including the load, found effective in low-pressure fumigation was 6 oz., with an exposure period of at least 2 hours. High-pressure fumigation was not consistently effective throughout the bale at any of the concentrations used.

In experiments with large commercial fumigating tubes, there was no consistent difference in the concentration of the gas in different parts of the tube, whether the fumigant was admitted as a gas or sprayed in as a liquid to volatilise automatically, except a slight tendency toward a higher concentration at the top of the chamber. In the centres of the bales, the concentration was lower in the middle layer than in the top or bottom layers of bales. This can be corrected by putting lengths of 4×4-inch timbers between the layers of bales. The concentration of HCN throughout a single bale was more uniform under low-pressure fumigation than under high-pressure fumigation. With the latter, the concentration was much lower at the centre of the bale than nearer the surface.

No economical method is apparent for a rapid removal of the residual gas from the interior of the bale. It passes out slowly by diffusion.

Experiments with bare larvae, larvae in seeds, and larvae in the centres of bales of cotton showed that a higher dosage of HCN was necessary to obtain complete mortality under high pressures than under low pressures. It was found that the temperature should be above 51°F. at the centre of the bale to insure a complete kill of the larvae in seeds inside the bale and adhering to the surface. Under low-pressure fumigation, infested seeds adhering to the outside of the bale are subject to a high concentration of the fumigant only while in the fumigation chamber. The gas remaining in the bales for some days after they are removed from the chamber plays an important part in the killing of the larvae in the interior of the bales. A high percentage of mortality was obtained even when the infested seeds were inserted into the bales after they had been removed from the chamber. On account of the extended period during which larvae inside the bales are subjected to the residual gas, there is little danger of survival after a low-pressure fumigation at temperatures of 45°F. or above.

In the fumigation of cotton at atmospheric pressure a complete kill of any larvae at a depth not greater than 3 inches within the bale can be expected with fumigation for 6 hours with 3 oz. HCN per 100 cu. ft. of space, including the cotton, if the temperature of the bale is not below 50°F. This method is more economical than fumigation under reduced pressure and is applicable to the fumigation of cotton that has been compressed or is to be compressed immediately.

Boyce (A. M.) & Maxwell (K. E.). **The new Citrus Bud Mite.**—*Calif. Citrogr.* **23** no. 3 pp. 109, 152, 5 figs. Los Angeles, Calif., January 1938.

Infestation of *Citrus* by *Eriophyes sheldoni*, Ewing [*cf. R.A.E.*, A **26** 173, 650] causes deformity of the leaves, fruit and flowers, reduction of new growth, multiple bud formation and a bunchy type of foliage. It is not known how long the mite has been in California, but abnormal fruits such as are now associated with infestation by it were observed at various times during the past 20 years, and foliage abnormalities in 1929. Injured leaves seldom occur on growth more than two years old. *E. sheldoni* has been found only on lemon, orange and grapefruit, and infestation of orange and grapefruit has not been of economic importance. The mites abound in the unopened buds and beneath the sepals of the young fruit, and are often present in the developing blossoms ; there are sometimes several hundred in a single bud. Eggs are found wherever mites are present, and both have been observed throughout the summer and autumn. In experiments on control, in which a large number of materials were tested, hydrocyanic acid gas fumigation, sulphur sprays, and oil sprays alone and in combination with rotenone-bearing materials gave very promising results. Since these are generally used for the control of Coccids and mites, it is probable that special measures against *E. sheldoni* will be unnecessary.

Adamson (A. M.). **Preliminary Report on Termites and Termite Damage in Trinidad, West Indies.**—*Trop. Agriculture* **14** no. 5 pp. 141–149, 2 pls., 8 refs. Trinidad, May 1937.

This preliminary survey of the termites of Trinidad and the damage they cause to timber contains a list of species that occur on the island, based on collections by H. E. Emerson and the author. These include 19 named species, as well as a number that are unidentified or are known to be undescribed. The total number of species present is considered to exceed 50. Notes are given on the individual genera and species, their habitats, distribution, runways and nests, and a table, based on the results of an examination of buildings in the north of the island, shows distinguishing characteristics in the nests, runways, galleries in wood and the soldier caste of the five species of economic importance. These, in descending order of destructiveness, are *Heterotermes tenuis*, Hag., *Calotermes* (*Cryptotermes*) *brevis*, Wlk., *Coptotermes testaceus*, L., *Microcerotermes arboreus*, Emerson, and *Eutermes* (*Nasutitermes*) *costalis*, Hlmgr., of which the first two caused 90 per cent. of the damage observed. It is thought that probably all houses more than a few years old are infested, and furniture is also affected. Some damage is caused to telegraph-poles, fences, etc., principally by *H. tenuis*, but its full extent is as yet unknown.

The available means of controlling infestation are reviewed from the literature ; they consist in insulation of susceptible wood, the use of resistant woods, chemical treatment of wood, and the destruction of the termites by fumigation with carbon bisulphide or poisoning with Paris green.

ADAMSON (A. M.). **Notes on Termites destructive to Buildings in the Lesser Antilles.**—*Trop. Agriculture* **15** no. 10 pp. 220–224, 10 refs. Trinidad, October 1938.

In this paper, the author gives notes on the termites of economic importance as pests in buildings in the Lesser Antilles, based on collections by himself during 5 years and by other workers. The most destructive species recorded were *Calotermes* (*Cryptotermes*) *brevis*, Wlk., and *Heterotermes tenuis*, Hag., in all the islands in which adequate search was made, and *Coptotermes testaceus*, L., in Trinidad, Tobago and Grenada. An unidentified species of *Coptotermes* was observed in Barbados.

The question whether precautions are necessary in the West Indies to prevent the introduction or spread of termites is discussed. The dry-wood termites are those most likely to be transported overseas, but *Calotermes brevis* is probably already present in all the inhabited islands, and few, if any, of the other Neotropical dry-wood species are thought to be a serious menace. Thus subterranean termites, particularly the two species of *Coptotermes* already present in some of the islands and others of the genus occurring in Central America, are probably those of chief importance, so that wood likely to have been in contact with the soil presents the greatest risk. Imports of wood from the tropics and particularly the American tropics should be subject to supervision in all islands.

COTTIER (W.). **Citrus Pests : 3 (a) Red Mite, (b) Thrips.**—*N. Z. J. Agric.* **57** no. 2 pp. 138–139, 4 figs. Wellington [N.Z.], August 1938.

Very brief notes are given on the bionomics of a red mite [*Paratetranychus citri*, McG.] and a thrips [*Heliothrips haemorrhoidalis*, Bch.] that attack *Citrus* in New Zealand, and on the types of damage they cause. The thrips is polyphagous [*cf. R.A.E.*, A **24** 136], but all stages of both species can be found on *Citrus* throughout the year. *P. citri* is easily controlled by spraying with a 1 per cent. summer oil emulsion, and the same spray, with the addition of nicotine sulphate (1 : 800), is recommended against the thrips.

FULLER (M. E.). **Notes on** *Trichopsidea oestracea* (**Nemestrinidae**) **and** *Cyrtomorpha flaviscutellaris* (**Bombyliidae**)—**two Dipterous Enemies of Grasshoppers.**—*Proc. Linn. Soc. N.S.W.* **63** pt. 3–4 pp. 95–104, 19 figs., 12 refs. Sydney, 15th September 1938.

Detailed descriptions are given of the young and full-grown larvae and pupa of *Trichopsidea oestracea*, Westw., parasitising *Chortoicetes terminifera*, Wlk., and other grasshoppers in New South Wales and the Federal Capital Territory, and of the full-grown larva and pupa of *Cyrtomorpha flaviscutellaris*, Roberts, the larvae of which feed on the eggs of *Austroicetes cruciata*, Sauss., in Western Australia [*cf. R.A.E.*, A **26** 629].

TONNOIR (A. L.). **On the Taxonomy of *Helicobia australis* (Sarcophaginae), a Dipterous Insect associated with Grasshoppers.**—*Proc. Linn. Soc. N.S.W.* **63** pt. 3–4 pp. 129–132, 2 figs., 8 refs. Sydney, 15th September 1938.

FULLER (M. E.). **On the Biology and early Stages of *Helicobia australis* (Sarcophaginae), a Dipterous Insect associated with Grasshoppers.**—*T.c.* pp. 133–138, 5 figs., 4 refs.

In the first paper, descriptions are given of both sexes of *Helicobia australis*, Johnst. and Tiegs; that of the male is based on type material, but the female, one of a series bred in cages containing grasshoppers from the neighbourhood of Canberra, is described for the first time. In the second paper, larvae of the first, second and third instars and the puparium are described and compared with those of *Sarcophaga*. Details are given of experiments in which the females preferred decomposed to fresh meat for larviposition, and meat or a newly killed mouse to dead grasshoppers, while they did not deposit larvae on live grasshoppers [*cf. R.A.E.*, A **26** 629]. Larvae did not survive when placed on live grasshoppers, but some survived on dead ones. They were successfully reared on meat for several generations. When newly deposited larvae were placed on a sheep, they became full-fed in 49 hours, by which time they had produced a brown irritated patch on the skin, though they were scattered in the wool round it. They were removed and allowed to pupate, and all gave rise to adults.

CURRAN (C. H.). **New Species and Records of Tachinidae (Diptera).**—*Proc. Linn. N.S.W.* **63** pt. 3–4 pp. 185–206, 2 figs. Sydney, 15th September 1938.

The new species described include *Besserioides* (gen. n.) *sexualis* reared from *Dysdercus sidae*, Montr., *Zenillia noctuae* from *Heliothis armigera*, Hb. (*obsoleta*, F.), *Cosmophila flava*, F., and an unidentified cutworm, and *Zenillia cosmophilae* from *C. flava* and *Cirphis unipuncta*, Haw., all in Queensland.

WASON (E. J.). **Red Mite. Control Tests on the Murrumbidgee Irrigation Area.**—*Agric. Gaz. N.S.W* **49** pt. 9 pp. 496, 503, 1 fig. Sydney, September 1938.

The results of preliminary experiments on the control of *Bryobia praetiosa*, Koch, on fruit trees in New South Wales, which have been in progress since 1933, were confirmed on the whole by tests carried out in 1937–38 on the comparative value of various summer and dormant sprays applied to infested prune trees. The mite deposits its eggs on the trees and also on the weeds and soil at the base of the trunk. To estimate the effectiveness of the sprays, it was therefore necessary to band half the trees before the overwintering eggs hatched. Of the dormant sprays tested, the most effective was red oil, which was used at a concentration of 1 : 20. The summer sprays were applied on 29th October and included 1 per cent. liquid lime-sulphur, with the addition of 5 lb. wettable sulphur per 100 gals., and 1 per cent. summer spraying oil. The former spray gave the best results and is recommended for almonds and prunes, while the addition of the summer oil to the 2nd, 3rd and 4th cover sprays against the codling moth [*Cydia pomonella*, L.] on apples, etc., should reduce infestation of these trees by *B. praetiosa* to a minimum. Cultivation to destroy weeds in the late winter or early spring eliminates many eggs; judicious irrigation increases the resistance of the trees.

MORGAN (W. L.). **Control of Bean Fly. Experiments demonstrate the Efficiency of Nicotine Sulphate-White Oil.**—*Agric. Gaz. N.S.W.* **49** pt. 9 pp. 501–503, 1 fig. Sydney, September 1938.

The experiments described have further demonstrated the effectiveness of sprays of nicotine sulphate in white oil emulsion for the control of *Agromyza phaseoli*, Coq., on French beans in New South Wales [*R.A.E.*, A **26** 335]. The sprays were applied at 4-day intervals, starting 3–4 days after the plants appeared above ground. Of five series of six plots sown, respectively, on 12th, 15th, 20th, 25th and 28th March 1938, the first received three sprays, the second, third and fourth two, and the fifth, one. The yields in bushels per acre averaged, respectively, 134, 120, 217, 141 and 143 on the treated plots, and 2, 8, 13, 35 and 62 on the controls.

[BORKHSENIUS (N. S.).] **Борхсениус (Н. С.). Coccidae of Quarantine Value for U.S.S.R. and their Allied Species.** [*In Russian.*]—Med. 8vo, 272 pp., 20 pp. refs., 72 pls. Tiflis, Div. sci. Lit., 1937. (With a Summary in English, pp. 246–255.)

This text-book is primarily intended to facilitate the identification of the 29 species of Coccids (a list of which is given) that are the subject of internal or external quarantines in the Russian Union, and of allied species, the total number dealt with amounting thus to 84 species. They belong to the subfamilies DIASPINAE, MONOPHLEBINAE, LECANIINAE, ERIOCOCCINAE and ASTEROLECANIINAE. An introductory chapter contains a discussion of the importance of Coccids in general, and information on their morphology and biology, food-plants, the injury caused and the history of their study in the Russian Union. A key to the five subfamilies discussed is included. The next five chapters deal with the subfamilies individually; they include keys to the tribes, genera and species, descriptions of the morphological characters peculiar to each tribe and genus, and lists of the species with notes on their distribution, importance and food-plants, the kind of injury they cause, and in some cases their morphology, bionomics and natural enemies. A further section comprises systematic lists of all the Coccids known to occur in the Russian Union, arranged under the 13 regions from which they have been recorded and showing their food-plants and the parts attacked. Instructions for the preparation of specimens for examination, a bibliography of the Russian and foreign literature, and an index to the insects mentioned in the book are appended.

WILKINSON (D. S.). **On a further two new Palaearctic Species of** *Apanteles* **(Hym., Brac.).**—*Proc. R. ent. Soc. Lond.* (B) **7** pt. 10 pp. 222–227, 6 figs. London, 15th October 1938.

Descriptions are given of both sexes of *Apanteles dioryctriae*, sp. n., reared from the Pyralid, *Dioryctria peyerimhoffi*, de Joann., mining in young cones of *Cedrus atlantica* in Morocco, and *A. coleophorae*, sp. n., from the Tineid, *Coleophora fuscedinella*, Zell., on elm and alder in England.

Wilson (F.). **Some Experiments on the Influence of Environment upon the Forms of** *Aphis chloris* **Koch. (Aphididae).**—*Trans. R. ent. Soc. Lond.* **87** pt. 6 pp. 165–180, 9 refs. London, 27th September 1938.

An account is given of investigations in Buckinghamshire on *Aphis chloris*, Koch, an Aphid that is apparently restricted to plants of the genus *Hypericum*. Under natural conditions, the eggs are deposited on the stems of *H. perforatum* during October and hatch in late March or early April. The fundatrices become mature a month later, and are followed by several generations of apterous viviparous females. By June, the colonies have become quite large, and some alate viviparous females develop and disperse to found fresh colonies. These alatae are common for a short time, but never constitute the majority of the population. During July, they become increasingly scarce and finally disappear. The succeeding generations usually consist only of apterous viviparous females until about mid-September, when adult males, and, somewhat later, apterous oviparous females appear. Concurrently, the apterous viviparous females become rarer, and very few are present after the first week in October. Many males arrive at maturity earlier than the oviparous females, and the latter continue to mature after all the males have become adult, so that they finally become more numerous.

The following is largely taken from the author's summary of his experiments : That the alate viviparous females are not essential to the cycle was demonstrated by a line, beginning from a fundatrix and ending with amphigonae, in which no alatae occurred. Repeated overcrowding resulted in the appearance of alatae. No temperature was found that favoured their appearance, and it is concluded that overcrowding is responsible, this being interpreted as a nutritional factor. It was shown that a line of Aphids may be continued for 77 filial generations (and probably indefinitely) without any amphigonae arising, and it follows that their appearance is not pre-determined for any particular generation from the fundatrix, but is essentially a result of environment. From an experiment in which nine lines derived from nine sister apterous viviparous females (35th filial generation from a fundatrix) were subjected to various temperature and light conditions, it was shown that high temperatures and many hours of exposure to light result in a line remaining parthenogenetic, that low temperatures and short exposures cause the appearance of oviparous forms, and that the two factors, light and temperature, are closely related so that the effect of either will vary according to the other.

When four lines beginning from the fundatrices were subjected to the conditions favourable for the production of oviparous females in the previous experiment, the same results were finally attained, but many more generations were required. This suggests that the form of the Aphid may also be influenced by a time factor, the nature of which is discussed. It was shown in two experiments that an apterous viviparous female can be induced to produce apterous viviparous female, male and oviparous female offspring, the nature of the progeny (parthenogenetic or amphigonous) being determined purely by the environmental conditions under which the parent female is kept. This result is in opposition to the customary belief that at least two generations must pass before suitable environmental conditions can result in the production of amphigonous individuals, and demonstrates the absence of a " sexuparous form " in *Aphis chloris*.

Males seldom occurred in the experiments, the conditions of which were very favourable either for viviparous females or, at the other extreme, for oviparous females. Field observations indicated that an environment favourable for the production of males was intermediate between these extremes.

PRINGLE (J. A.). **Observations on certain Wood-boring Coleoptera occurring in South Africa.**—*Trans. R. ent. Soc. Lond.* **87** pt. 11 pp. 247–270, 1 pl., 5 figs., 13 refs. London, 27th September 1938.

Detailed descriptions, based on material from South Africa, are given of the full-grown larvae and pupae of *Lyctus brunneus*, Steph., and of the following Bostrychids : *Xylopsocus sellatus*, Fhs., found in exposed barked poles of *Acacia melanoxylon* ; *Heterobostrychus brunneus*, Murray, in seasoned timber of *Copaifera coleosperma* and *Pterocarpus angolensis* ; *Xylion adustus*, Fhs., in seasoned timber of *C. coleosperma* and, occasionally, in *Eucalyptus globulus* ; and *Enneadesmus forficula* subsp. *capensis*, Lesne, in a dry branch of *Acacia karroo*. It is not known whether the last-named usually infests *A. karroo* ; the timber is not used commercially to any extent. Very brief notes are given on the bionomics of some of these species, and more detailed ones on the general morphological and biological characters of Lyctids and Bostrychids.

PRINGLE (J. A.). **A Contribution to the Knowledge of** *Micromalthus debilis* **LeC. (Coleoptera).**—*Trans. R. ent. Soc. Lond.* **87** pt. 12 pp. 271–286, 16 figs., 1 pl., 7 refs. London, 27th September 1938.
PATERSON (N. F.). **On the external Morphology of South African Specimens of** *Micromalthus* **(Coleoptera).**—*T.c.* pp. 287–290, 8 figs., 7 refs.

In the first paper, records are given of infestation of timber in gold mines on the Witwatersrand (Transvaal) by larvae of *Micromalthus debilis*, Lec. They were first found in 1932 in a shaft at a depth of about 6,000 ft., and observations in 1934 showed that they were attacking a certain amount of the timber in all mines from which material was examined, which comprised most of those along the central Reef area. This beetle had previously been recorded only from North America. It is possible that it was introduced into South Africa in pitch pine, which was imported in large quantities from North America for use in the mines when they were first opened about 50 years ago. It is also possible that it occurs in some of the moist forest areas of South Africa, but it has not been recorded there. The timbers most extensively used in the mines are *Acacia* sp., *Eucalyptus* sp., and *Pinus* sp., most of which are treated, but all are equally infested if there is sufficient moisture, and it is probable that all other types of timber would also be attacked under similar conditions. The heaviest infestations occurred in timber that had been underground for many years in the older, badly ventilated shafts. The temperature in most mines varies from 88 to 93°F., according to the depth and ventilation. In one worked-out drive with a temperature of 93°F., where there was much stagnant or running water, conditions appeared to be optimum for the insect, and many uprights 12 ins. in diameter were completely decayed or pulverised. In most shafts with good ventilation and temperatures of 88–90°F., infestation was lighter. The majority of the timbers attacked by *Micromalthus* were also infested by fungi.

During investigations into the complex life-history of the beetle, the interpretation of which is discussed from the literature, infested timber was collected from different levels in various mines for over three months and carefully examined. Adult females, pupae and paedogenetic, cerambycoid and triungulin larvae were found, but no males or their larval predecessors. Some triungulin larvae, produced by paedogenetic forms, changed into cerambycoid larvae within a week, while in others the onset of this stage was delayed. After three weeks, some larvae had changed from the first to the second cerambycoid stage, but there was considerable variation in the rate of development. Pupae, which later would give rise to adult females, and viviparous paedogenetic larvae occurred close to each other in the same wood. Detailed descriptions are given of the three larval forms and the pupa.

In the second paper, the external morphology of the female adult, which was rare in the mines, is described and compared with that of the species as occurring in North America. It is concluded that although the South African form differs in certain respects, there is not sufficient evidence for considering it a distinct species. Certain factors, such as the peculiar environment, which is practically the same all the year round, may have led to slight variations, which from cursory examination might appear to have unwarranted significance.

BUTLER (C. G.). **On the Ecology of** *Aleurodes brassicae* **Walk. (Hemiptera).**—*Trans. R. ent. Soc. Lond.* **87** pt. 13 pp. 291–311, 5 figs., 17 refs. London, 27th September 1938.

The following is largely taken from the author's summary of investigations at Cambridge on the bionomics of the cabbage whitefly, *Aleurodes brassicae*, Wlk., with particular reference to the effects of the biotic and physical characters of its environment : The egg and larval instars are described and figured. Four or five generations occurred between May and October, the females being slightly more abundant in the field then than the males. Males that have paired die during the winter, but the females shelter on the food-plants and can withstand a temperature of −14°C. [6·8°F.]. Nearly all parthenogenetic eggs give rise to males, whereas fertilised eggs give rise to approximately equal numbers of both sexes. Descriptions are given of experiments in the laboratory and in the field, showing that the adults have a marked preference for certain varieties of *Brassica oleracea*. Breeding occurred on most varieties of this plant and also on *Cheiranthus*, *Taraxacum officinale* (*dens-leonis*) and *Sonchus oleraceus*, but not on the pickling variety of cabbage, or on a number of other plants, including various crucifers, on which the adults have been seen in the field. The adults showed a well-marked response to the odour of cabbage and were also attracted by light of a wave length similar to that reflected from cabbage leaves. They tended to move from low to high humidity.

The adults were able to live for 15 days on artificial media containing starch and sugar, and for a shorter period if starch or sugar alone was present. It is concluded that the insect injures its food-plant by the removal of certain nutritive substances, principally starch and sugars ;

and that it hinders assimilation and transpiration by the secretion of wax and honey-dew. The honey-dew causes further damage by encouraging the growth of certain moulds.

LEA (A.). **Investigations on the Red Locust** *Nomadacris septemfasciata* **(Serv.), in Portuguese East Africa and Nyasaland in 1935.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 176, 29 pp., 9 refs., 4 figs. Pretoria, 1938. Price 3*d.*

From July to November 1935, a survey was made by car of the greater part of Portuguese East Africa and southern Nyasaland, to investigate the possible outbreak centres of *Nomadacris septemfasciata*, Serv., and to study its ecology and habits. *Nomadacris* was found to be present in swarms, which occurred in fair numbers only in the southern part of Portuguese East Africa, and also as scattered or solitary individuals. Although the swarms flew indiscriminately over all types of country, the solitary locusts were only found in grassland devoid of trees and bush, usually in the neighbourhood of streams or lakes and characterised by such plants as *Cynodon*, *Cyperus*, *Sorghum* and *Hygrophila*. Their colouration sometimes coincided with that of the background.

It was concluded that there is no evidence of the existence of outbreak centres of *Nomadacris* anywhere in the surveyed area, though ph. *solitaria* may survive in some localities without ever increasing sufficiently to form swarms. The part of Portuguese Nyassa where some individuals of *Nomadacris* were found in 1931, a year in advance of the 1932 invasion, was found to consist of dense *Brachystegia* woodland, interspersed with arid valleys, and is entirely unsuitable for this species [*cf. R.A.E.*, A **26** 683]. The field observations and a study of the biometrical characteristics of both the solitary-living individuals and those from swarms suggest that the former are mostly stragglers from swarms or their progeny.

FRAPPA (M. C.). **Madagascar: Behaviour of** *Locusta migratoria* **var.** *capito* **during the Campaign 1937–38.**—*Int. Bull. Pl. Prot.* **12** no. 10 pp. 213M–214M. Rome, October 1938.

Formerly it was thought that the outbreak centres of *Locusta migratoria capito*, Sauss., in Madagascar were confined to the semi-desert region between the rivers Onilahy and Mandraré, in the south-western part of the island [*cf. R.A.E.*, A **22** 8; **27** 14], but recent observations suggest that they stretch further north, to the river Mangoky. There was an outbreak of hoppers near Betioky in March 1937, and a campaign was organised for 1938. It began in early January when hoppers made their appearance, the second generation hatching about the middle of March. Altogether 14,635 man-days were required for control, and although the measures taken to prevent migrations in most cases insured the protection of crops, some damage was caused to native maize.

The Netherlands: Outbreak of the Colorado Beetle in 1938.—*Int. Bull. Pl. Prot.* **12** no. 10 pp. 214M–215M. Rome, October 1938.

All potato crops round the foci of infestation by *Leptinotarsa decemlineata*, Say, found in Holland in 1937 [*cf. R.A.E.*, A **25** 763] were treated three times with lead arsenate in 1938; two foci were completely destroyed, but some adult beetles were caught on trap plants in the third. An inspection service was organised for a strip about 9 miles wide along the southern frontier, but large swarms of the beetle crossed this strip and it was necessary to extend considerably the inspected area. The first swarm settled during June 1938 in the south-west, but the number of adults, eggs and (later) young larvae collected was small. In this region all potato fields, small plots and gardens were inspected several times and twice treated with lead arsenate to prevent the formation of foci. During July, a swarm settled more towards the south and south-east. All localities in which adults or larvae were reported were treated according to the measures recommended by the International Committee [**26** 467]. The beetle was reported in 147 communes, but in many, particularly in the north of the infested zone, the reports referred to one adult or to the larvae from one egg mass.

TISCHLER (W.). **Zur Oekologie der wichtigsten in Deutschland an Getreide schädlichen Pentatomiden. I.** [The Ecology of the most important of the Pentatomids infesting Cereals in Germany.]—*Z. Morph. Ökol. Tiere* **34** no. 3 pp. 317–366, 14 figs., 25 refs. Berlin, 1938.

Observations in two rye-growing areas in Schleswig Holstein during 1937 on the bionomics and ecology of Pentatomid bugs injurious to cereals largely confirmed those made in the previous year [*R.A.E.*, A **26** 51]. The species present were the same. The bugs preferred to overwinter on southerly or south-westerly slopes and in the neighbourhood of deciduous woods. Overwintered adults emerged from their winter-quarters about 10th April, when the temperature in the shade reached 18°C. [64·4°F.], but an ensuing cold spell caused them to cease activity until the end of the month. The spring resumption of activity probably depends more on the temperature of the soil than on that of the air. All the species were active when the soil temperature reached 15–16°C. [59–60·8°F.]. The first feeding occurred on *Festuca ovina* in the winter-quarters, and pairing began in late April. Maturation feeding on grasses, including young cereals in fields, occurred after migration. The species of food-plant had no influence on the date of oviposition, which began at the end of May. Females of *Eurygaster maura*, L., preferred to oviposit on wild grasses at the edge of the rye-fields, and very few eggs of this species were laid on the rye itself. The eggs of *Aelia acuminata*, L., were mostly deposited on *Festuca ovina*, and those of the other species on grasses or rye. The nymphs began to hatch at the beginning of June, and migrated to rye, on which they completed their development. Both nymphs and adults still fed on rye in sheaves after harvest in July. Feeding was not hindered by rain, which softened the grains, or by darkness, but wind caused the bugs to seek shelter. Individuals began to seek winter-quarters in the first half of September, and by the end of October all had disappeared from the fields.

Observations have shown that cool damp weather in May and June is unfavourable to the development of the bugs, but warm dry weather in these months in two successive seasons causes an outbreak.

Many overwintering individuals were found in April to have been killed by predators or by the fungus, *Beauveria* (*Botrytis*) *bassiana*, and later the nymphs were also attacked by predators, including *Staphylinus olens*, Müll., and ants. Tachinid parasites bred by the author were *Lophosia fasciata*, Mg., and *Cistogaster globosa*, F., from *A. acuminata*, and *Gymnosoma rotundatum*, L., from *Carpocoris pudicus fuscispinus*, Boh., and *Palomena prasina*, L. *Microphanurus* (*Telenomus*) *semistriatus*, Nees, emerged from eggs of *E. maura*, eggs parasitised by this Scelionid being particularly numerous in late June.

Kunike (G.). **Die Feststellung des Nährwertes verschiedener Stoffe durch Frassversuche mit Vorratsschädlingen.** [The Determination of the nutritive Value of various Substances by Feeding Experiments with Pests of stored Products.]—*Anz. Schädlingsk.* **14** pt. 9 pp. 101–105. Berlin, 15th September 1938.

Pests of stored products have more or less specialised food-requirements, but laboratory tests excluding free choice are necessary to ascertain what substances are actually capable of affording them nutriment.

In experiments in which eggs of *Ephestia kuehniella*, Zell., were placed on 33 different substances, the larvae developed on 22, the shortest time to adult emergence being 37 days on flour of unripe grains of spelt (*Triticum spelta*) and the longest 96 on cacao beans. On the basis of rapidity of development, the most suitable foods were flour, groats and flakes that were of higher nutritive value because they contained bran, and of which the particles were small enough to be easily attacked by the young larvae. Entire grains, which must contain all the nutritive components, came next, followed in descending order of suitability by flours that did not contain all the bran, pulses, the groats of which, though containing all the food values, were comparatively hard, ground-nuts, oats, sweet almonds, dried fruit, and cacao beans. On the basis of the number of adults obtained per 1,000 eggs, the order of suitability of the foods was not exactly the same, but the nutritive values were clearly shown. The results included 556 adults (the largest number) from bean groats, 471 from groats of unripe grains of spelt, 96 from cacao beans, and 6 (the smallest number) from oats. Moths of normal size (11–12 mm. long) resulted from most of the foods ; those of larger average size were from bean groats, rye, sweet almonds and oat flour.

It is suggested that the reason why *E. kuehniella* occurs, with few exceptions, in flour mills and not in grain warehouses is the higher temperature in steam mills, for it is almost absent in windmills and water-mills, where the temperature is low, especially in winter.

Tests were also made of the suitability of various forms of rice and rice products as food for *E. kuehniella* and *Calandra oryzae*, L. Neither insect was able to feed on unhusked rice, but both throve on husked, but otherwise untreated rice, the particles on the surface of which are highly nutritive. The numbers of progeny obtained in three months from 100 adults of *Calandra* were 476 in untreated husked rice, 15 in polished rice and 15 in glazed rice. Larvae of *Ephestia* could not feed on the glazed rice ; they were able to feed on the polished rice, but only a few gave rise to adults. Rice fodder meal (the waste obtained when rice is polished) was the most favourable food for *Ephestia*, 200 eggs giving rise to 193 adults, the highest number obtained.

Neither *Ephestia* nor *Calandra* attacked potato starch products, possibly because they failed to recognise them as foods. It is suggested that the flours and groats of grains have the same scent stimulus as the entire grains, which were presumably the original food of these insects, and that this stimulus is lacking in potatoes and products from them. *Tribolium castaneum*, Hbst. (*navale*, auct.) attacked potato flour, but it does not feed on entire grains, which are therefore not its original food.

THALENHORST (W.). **Die Puppengewicht-Eizahlrelation der Forleule** (*Panolis flammea* **Schiff.**). [The relation between Pupal Weight and Number of Eggs in the Pine Noctuid, *P. flammea*.]—*Anz. Schädlingsk.* **14** pt. 9 pp. 105–109, 2 graphs, 4 refs. Berlin, 15th September 1938.

For forecasting the probable degree of infestation by *Panolis flammea*, Schiff., of pines in Saxony, estimates of the numbers of pupae and an attempt to determine the relation between the weights of the female pupae and the numbers of eggs laid by the resulting moths have been made. The average egg production in different weight groups and localities is plotted in a graph. In general, the number of eggs increased with an increase in pupal weight, an average weight of about 0·3 gm. indicating about 150 eggs per female. A curve obtained from the various points in the graph may be used for estimating the average numbers of eggs for the average pupal weights, but requires further investigation and confirmation.

BERAN (F.). **Zur Kenntnis der Obstbaumkarbolineumemulsionen. III. Teilchengrösse und pflanzenschädliche Wirkung.** [A Contribution to the Knowledge of Fruit-tree Carbolineum Emulsions. III. Droplet Size and Action injurious to Plants.]—*Anz. Schädlingsk.* **14** pts. 8–9 pp. 95–97, 109–111. Berlin, 15th August–15th September 1938.

In further experiments with tar-distillate emulsions having droplets of different sizes [*cf. R.A.E.*, A **25** 268], it was found that emulsions of a coarse dispersion injured plant buds less than those of a fine dispersion having the same oil content, and that their coarse dispersion is the explanation of the fact that the soap-free tar distillates known as "Baumspritzmittel" [*cf.* **24** 797, etc.] are much less harmful than the normal fruit-tree carbolineums.

Elm Disease *Ophiostoma ulmi* (**Syn.** *Ceratostomella* (*Graphium*) *ulmi*).—*Leafl. For. Comm.* no. 19, 8 pp., 5 figs., 1 map. London, December 1928; revised February 1938.

The elm disease caused by the fungus, *Ophiostoma* (*Ceratostomella*) *ulmi*, has been known in Great Britain since 1927, although it was probably present at an earlier date. A map shows that it had a fairly general distribution over southern and central England in 1937, but it is unknown in Scotland [*cf. R.A.E.*, A **21** 171]. Its distribution in Europe and the United States is briefly indicated. Descriptive notes are given on the signs of attack, the fungus, and the galleries of the bark-beetles, *Scolytus scolytus*, F. (*destructor*, Ol.) and *S. multistriatus*, Marsh., that are responsible for its spread. The adult beetles may emerge through the bark at any time from May to October provided that the weather is warm enough, and those that emerge before July are probably the more important as carriers of the fungus. The age and species of elm attacked and the recovery of infected trees are discussed. Since its diminution in 1932 [*loc. cit.*], the disease has made steady progress, which has been rapid in certain districts during recent years, but, except in a few areas, the proportion of trees actually killed is small. The disease is too widely distributed in England to allow of its eradication. The bark of felled or wind-blown elms that cannot be utilised immediately should be stripped and burnt to prevent its serving as a breeding ground for the beetles. It is very important to avoid leaving piles of unbarked elm branches, for these can be centres of infection.

BLISS (C. I.). **The Determination of the Dosage-Mortality Curve from small Numbers.**—*Quart. J. Pharm.* **11** no. 2 pp. 192–216, 3 graphs, 5 refs. London, 1938.

It is known that if the percentage of organisms killed by a given toxic agent is plotted against the dosage, an asymmetric sigmoid curve is obtained in the case of multicellular forms [*R.A.E.*, A **23** 493], and that most of these curves can be converted to straight lines by transforming dosages to logarithms and percentages to a function of the normal curve such as the probit [**22** 440]. The individual values in such a series, however, seldom have the same inherent reliability, and for this reason should not be weighted equally in computing the best-fitting dosage-mortality curve. When all of the observations fall upon or close to a single straight line, the exact weighting scheme is of little importance, but when the variation is more extensive, as is frequently the case with small numbers, both the weight and the exact value of the probit are subject to correction. The present paper is concerned with a description of these corrections and of their application to small series.

Thirty-second Annual Report of the Department of Agriculture (British Columbia) for the Year 1937.—108 pp., 1 pl. Victoria, B.C., 1938.

The Report of the Horticultural Branch of the Department of Agriculture in British Columbia (pp. K 24-K 43), by W. H. Robertson, includes a brief account of work on the control of the codling moth [*Cydia pomonella*, L.] on apple; the results of spraying tests are tabulated in an appendix (p. K 103) and show that thiodiphenylamine (phenothiazine) was on the whole rather less effective than lead arsenate in reducing infestation, but the former was used at the rate of 1 lb. to 48 gals. and the latter at 1 lb. to 30 gals. The mealybug [*Pseudococcus* sp.] attacking fruit-crops, chiefly apple, in the Kootenays was not satisfactorily controlled by the 6 per cent. oil spray that had previously been found effective [*R.A.E.*, A **26** 59].

In the Report of the Provincial Plant Pathologist (pp. K 43–K 51), by J. W. Eastham, it is stated that wheat-midge, *Sitodiplosis* (*Thecodiplosis*) *mosellana*, Géh., has become a serious pest of wheat in the coastal areas, causing almost complete failure of the crop in some cases. Its development has been favoured by more moisture than usual in recent years in June and July, and the presence of wheat stubble in the winter. It appeared that early winter varieties were resistant to the midge, but that spring varieties were very susceptible.

In the Report of the Provincial Entomologist (pp. K 51–K 53), by M. H. Ruhmann, records are given of the prevalence of the principal pests during the year. *Leptinotarsa decemlineata*, Say, which was first reported on potatoes in British Columbia in 1922 [**11** 576], was again found in 1937, in a small area in the West Kootenay district where it had apparently been present also in 1936. Infested plots of potatoes were dusted with calcium arsenate, but adults began to emerge towards the end of July. About 800 were collected from 12 potato plots.

BEDARD (W. D.). **An annotated List of the Insect Fauna of Douglas Fir** (*Pseudotsuga mucronata* **Rafinesque) in the northern Rocky Mountain Region.**—*Canad. Ent.* **70** no. 9 pp. 188–197. Orillia, September 1938.

This systematic list of 153 insects taken on Douglas fir, *Pseudotsuga taxifolia* (*mucronata*), in the northern Rocky Mountain region of the United States and Canada includes those that feed on the tree and their natural enemies. Brief notes are given on the injury caused and the stages observed, and in the case of parasites and predators, on the species attacked.

FARRAR (M. D.), FLINT (W. P.) & BIGGER (J. H.). **Oil Baits for Grasshopper and Armyworm Control.**—*Bull. Ill. agric. Exp. Sta.* no. 442 pp. 413–420, 2 refs. Urbana, Ill., April 1938.

In consequence of the successful use against grasshoppers of bran baits in which oil is substituted for molasses and water [*R.A.E.*, A **22** 277], these baits were tested in Illinois against army-worms and other cutworms [**23** 318; **25** 420] as well as grasshoppers. The advantages of oil baits over those containing molasses [*cf.* **22** 278] include the possibility of storing them for over a year without deterioration and an apparent improvement after a month's storage, owing to the permeation of the oil. Mineral oils (viscosity S.A.E. 20–30) were cheaper and more effective than vegetable oils, and a mixture of equal parts of wheat bran and maize-cobs ground to the same degree of fineness proved as effective a carrier as bran alone, and cheaper. The most effective poisons used were 4 lb. crude or refined white arsenic, sodium pyroarsenate, sodium fluosilicate or Paris green, or 3 lb. dry sodium arsenite, per 100 lb. carrier; the results given in this bulletin are not so arranged as to show any difference in their efficiency. The bait is prepared by thoroughly mixing the poison and the carrier, adding 2 U.S. gals. oil and stirring the mixture until every particle of the carrier is coated with oil.

In tests in 1934, the percentage mortalities of *Prodenia ornithogalli*, Gn., and *Laphygma frugiperda*, S. & A., on lucerne were 85·5 with molasses baits, 81·0 with baits containing oil (viscosity S.A.E. 30) and 12·7 on untreated plants. In 1935, these percentages for *Cirphis unipuncta*, Haw., on cereals were 67·0, 69·4 and 12·5, respectively. The oil baits gave as good control of mixed populations of grasshoppers on soy beans and miscellaneous field crops as those containing molasses, and they were extensively and successfully employed by farmers for the control of both grasshoppers and army-worms in 1937. Crankcase oil, reclaimed crankcase oil, fuel oils, oils of viscosity S.A.E. 10 or less, and those having a high sulphur content or a pronounced odour should not be used. On soy beans, the baits should be spread uniformly and at a rate of not more than 10 lb. per acre, otherwise serious scorching may result. When oil was used in bran poisoned with Paris green the leaves were not injured, but the corresponding molasses-water bait and one of sodium arsenite and water caused considerable injury.

KASTON (B. J.) & RIGGS (D. S.). **On certain Habits of Elm Bark Beetles.**—*J. econ. Ent.* **31** no. 4 pp. 467–469, 3 figs., 1 ref. Menasha, Wis., August 1938.

The following is mainly the authors' summary: The native elm bark-beetle, *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., before constructing brood galleries in sickly elms, first makes feeding tunnels in healthy elms. These tunnels are in the bark alone and do not touch the surface of the wood. The trunk of the tree is preferred, but tunnels may be found from the exposed roots all the way up to branches less than an inch in diameter. Usually, more than one feeding tunnel is made by each beetle. Bark tunnels made for hibernation [*cf.* next paper and *R.A.E.*, A **24** 180] tend to be longer, and are more often in thicker bark, than the otherwise similar feeding tunnels. It is believed that the tunnel feeding is analogous to the well-known crotch and twig feeding of *Scolytus multistriatus*, Marsh. [**22** 392, 606] and hence important in relation to the spread of the fungus [*Ophiostoma ulmi*] causing Dutch elm disease. When adults were enclosed in a cage containing only freshly cut twigs of healthy elm, feeding tunnels were made in these, but when a choice was given, logs were attacked in preference to twigs.

MARTIN (C. H.). **Field Notes on the Life History of *Hylurgopinus rufipes* (Eich.).**—*J. econ. Ent.* **31** no. 4 pp. 470–477, 3 figs., 8 refs. Menasha, Wis., August 1938.

The life-history of *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., was studied in south-eastern New York during the period 1935–37. Observations were made on logs of American elm [*Ulmus americana*] 2½–3 ft. long and having an average diameter of 5–6 inches, cut at intervals of about two weeks throughout the season of beetle activity. In 1936 and 1937, the logs were divided among four of the stations used in 1935 [*R.A.E.*, A **24** 523], one in deep shade, two in medium shade and one without shade.

In this district, 80–90 per cent. of the population passes the winter in the adult stage and the remainder in the larval stage [*cf.* **24** 139]. The adults leave hibernation in late April or May and oviposit. The early spring eggs give rise to adults that oviposit and produce hibernating larvae, the spring eggs to hibernating adults and the summer eggs to hibernating larvae. Early spring eggs and spring eggs and probably summer eggs may also give rise to larvae that enter a diapause, passing through either one or two winters and becoming summer pupae, the adults from which give rise to hibernating larvae. Larvae begin to hatch from spring eggs in the first fortnight of June, and most of them pupate in late July or early August; the adults emerge from early August and apparently go into hibernation immediately. The time when the adults begin to enter logs in the spring appears to depend upon weather. In the years under review, it varied from late

April in 1936 and 1937 which were advanced seasons, to 25th May in 1935 when spring was late. There was a main population peak in the logs between 19th and 26th May 1937 and a much slighter one at the end of June, after which numbers decreased until entries ceased in September. There were also indications of a primary and secondary peak in 1935, but less of a secondary peak in 1936.

Infestation was heavier in the shade than in the sun, but the degree of shade did not seem to have any influence. The part of a log exposed to the sun becomes hot enough to kill the beetles attempting to enter it. Also, the heat during July and August often causes the bark to shrink and split, and most of the beetles avoid this area. Individual beetles sometimes remained in sight in the spring for two or three days before completing entry, and in a few cases, entry holes of *Scolytus* were used. There are usually two, or sometimes three, maternal galleries of unequal length extending from one entrance hole, usually between the phloem and xylem. The average length of tunnels measured in 1935 was about 3·55 cm., and the average number of eggs per tunnel 56·1, though only 3·9 beetles emerged, population being reduced by parasites, predators and adverse conditions in the log. The average numbers of unhatched eggs and larvae, separately and combined, per tunnel, found in logs examined between 5th June and 31st July 1935, are plotted on a graph. Oviposition by most of the beetles began about a week before the first count. The number of eggs and larvae per tunnel increased until 19th June ; after this it fell slightly and remained close to the average for the season until the last few days of July, when it rose considerably. The number of unhatched eggs reached its peak on 19th June and then fell rapidly until 17th July and gradually until 1st August. Most of the eggs, therefore, were laid within a period of three weeks. Live females with mature ova were found as late as 23rd July, and live females without mature ova until 1st August. Larvae were first found on 19th June, and their numbers steadily increased until 30th July, 93·8 per cent. of the eggs having hatched by 17th July. Pupae were first observed in mid-July in 1935 and on 9th July in 1936 and 1937, and were first found in numbers on 30th July, when it was estimated that there were 1–5 per maternal tunnel. Adults began to emerge during the first week of August in 1935 and by 20th July in 1936 and 1937. In 1935 only, a few made winter tunnels in the trap logs, but usually they preferred live, standing trees.

Todd (J. N.). **Effective Duration of Toxicity to the Mexican Bean Beetle of Derris Deposits on Foliage.**—*J. econ. Ent.* **31** no. 4 pp. 478–479, 1 ref. Menasha, Wis., August 1938.

Investigations on the rate at which insecticides containing rotenone deteriorate when exposed to sunlight [*cf. R.A.E.*, A **21** 339] were carried out in South Carolina in 1937. For this purpose, dusts or sprays of derris powder (5 per cent. rotenone) diluted with talc or water were applied to bean plants in pots, of which some were protected from sun and rain in a screened insectary and others were left exposed. Tests were made 0–14 days later on the protected plants (the leaves of which did not remain succulent longer) and 3–20 days later on the exposed ones, by caging 25 larvae or adults of *Epilachna varivestis*, Muls., on each. Counts were made three days after the beetles were placed on the plants. Foliage treated with dust containing 0·75 per cent.

rotenone and exposed retained some toxicity for 14 days, according to mortality records, but the condition of the foliage did not indicate any protection after the fifth day. After 6–8 days, all the beetles were dead or moribund, but as much foliage was consumed as on untreated plants. A spray containing 0·018 per cent. rotenone gave much less protection and lost its toxicity sooner, but there was evidence of toxicity after 6–8 days both in mortality and the amount of plant tissues consumed. In the shade, all plants were protected from injury, and mortality was high for 14 days. Three egg masses were deposited on the shaded plants in the first 3 days of the test. The eggs in the first did not hatch, those in the second hatched but the larvae died without feeding, and those in the third hatched and the larvae fed a little but died in the first instar.

FARRAR (M. D.) & FLINT (W. P.). **Soybean Flour as a Spray Material.**—*J. econ. Ent.* **31** no. 4 pp. 482–485, 3 refs. Menasha, Wis., August 1938.

Experiments in which soy-bean flour, which is chemically inactive and therefore compatible with nearly all sprays, was used as a spreader for many different types, were begun in Illinois in 1934. The spreading and adhesive qualities of the sprays are increased by the water-dispersable colloids in the flour, and these are only slightly affected by the hardness of the water. The minimum amount of the flour required to give a very even deposit of lead arsenate is 1 lb. per 100 U.S. gals., but this amount results in excessive run-off and was found to reduce the efficiency of sprays containing lead arsenate, calcium arsenate or synthetic cryolite against larvae of the codling moth [*Cydia pomonella*, L.] in laboratory and field experiments over a period of 3 years. The addition of less than 1 lb. flour, however, resulted in better kill than when none was used. Limited experiments indicated that 4 oz. per 100 U.S. gals. gives maximum efficiency. Soy-bean flour may also be useful as an emulsifier for oil [*R.A.E.*, A **24** 432], and its addition at the rate of 5 lb. to 95 lb. will make dusting sulphur easily wettable.

MUNRO (J. A.) & SCHIFINO (L. A.). **Potato Spraying Experiments in North Dakota.**—*J. econ. Ent.* **31** no. 4 pp. 485–487, 6 refs. Menasha, Wis., August 1938.

This is a preliminary report of studies directed towards the formation of a spray programme for potatoes in North Dakota. The treatments compared were Bordeaux mixture (6 : 3 : 50) alone and in combination with 2 lb. calcium arsenate or barium fluosilicate (Dutox) per 50 U.S. gals. spray. Each treated plot received four applications of about 85 U.S. gals. per acre, the first on 17th July and the succeeding ones at intervals of 10–14 days. All plots, including controls, were sprayed once with calcium arsenate to control *Leptinotarsa decemlineata*, Say. Population counts were made on the second day after each application. The most abundant pest was *Epitrix cucumeris*, Harr. Adults and nymphs of *Empoasca fabae*, Harr., were present from 1st July to the end of the season, but were not numerous and caused no appreciable damage in the early part of the season. All treated plots gave significantly greater yields than the control, the treatment including calcium arsenate giving the best and that including barium fluosilicate the worst results [*cf. R.A.E.*, A **22** 281]. All treatments also reduced the populations of *Epitrix* and *Empoasca*, but not in the same order of efficiency. In view of this and the small population of *Empoasca*, it does not seem possible that the control of the pests accounts entirely for the increased yield [*cf.* **26** 140].

MUNRO (J. A.) & SCHIFINO (L. A.). **Preliminary Studies of Wireworms affecting Potato Tubers in North Dakota.**—*J. econ. Ent.* **31** no. 4 pp. 487–488. Menasha, Wis., August 1938.

A survey of potatoes in 50 farms in 5 counties of North Dakota in 1937 showed that 14·8 per cent. of the tubers were injured by wireworms. Potatoes are subject to attack at any stage of development, but injury late in the season is the most common and serious in North Dakota. An examination showed that *Corymbites aeripennis destructor*, Brown, was the most abundant wireworm, and it is thought to be the only one of economic importance. On 70 potato hills examined to determine its abundance in autumn in relation to tuber injury, there were averages of 4·58 tubers, 1·56 injured tubers, 4·48 wireworm holes and 1·22 wireworms per hill.

TURNER (N.) & WALKER (G. L.). **Control of Onion Thrips.**—*J. econ. Ent.* **31** no. 4 pp. 489–491, 4 refs. Menasha, Wis., August 1938.

Field tests on the control of *Thrips tabaci*, Lind., on onions were carried out in Connecticut during 1933–37. In 1933, nicotine sulphate (1 : 800), a proprietary pyrethrum spray and one containing rotenone, all with the addition of 0·5 per cent. (by dry weight) potash coconut-oil soap, applied on 9th and 20th June to set onions, all reduced the number of thrips, the nicotine sulphate slightly more than the others. They did not increase the yield, the number of thrips per untreated plant (20) being probably too low to affect it. The nicotine and soap spray applied to a small field of onions on 2nd, 9th, 19th and 28th June reduced the number of thrips, sometimes by as much as 90 per cent., but the population increased rapidly after spraying. In 1934, a dust of 2 parts naphthalene and 3 parts hydrated lime [*cf. R.A.E.*, A **22** 280] applied to set and seed onions in July injured the plants and at no time reduced the thrips population by more than 50 per cent. In 1936, dusts of cubé and sulphur, separately and in combination, did not give satisfactory control, and the sulphur injured the onion tops.

In 1937, *T. tabaci* was abundant in late May, and had damaged set onions by mid-June. Three tests were made, in which the materials used with the quantities per 50 U.S. gals. water were: 2 lb. pure ground cubé root (4 per cent. rotenone); the same plus Ultrawet (1 : 800 and 1 : 1600), plus Aresket (1 : 1600) and plus 4 lb. sulphur mixed with Ultrawet (1 : 1600); 4 lb. sulphur mixed with Ultrawet (1 : 1600); and nicotine sulphate (1 : 800) plus Ultrawet (1 : 1200) and plus Aresket (1 : 1600). In the first test, in which applications of all sprays except those containing sulphur were made to set onions having an average infestation of 95 thrips per plant, on 16th and 25th June and 1st July, after which they were discontinued because the plants were killed by downy mildew, the addition of a spreader to cubé increased its effectiveness, Ultrawet at 1 : 1600 was more effective than at 1 : 800, Ultrawet was as effective as Aresket, and cubé with a suitable spreader was more effective than nicotine sulphate, the usual control material. In the second test, in which nicotine sulphate was not used and applications were made on 8th and 16th July to plants having an average infestation of 348–537 thrips per plant, the combination of cubé, sulphur and Ultrawet gave much the best result after one application, when the temperature was abnormally high, but after the second, made when the weather was much cooler, this and the cubé and Ultrawet were the best and about equally effective. In the third test, in which these two sprays were applied to seed onions with a light infestation on 16th, 23rd and 30th July and 6th August, applications of cubé and Ultrawet kept the infestation low, while the addition of sulphur did not improve control and injured the onions. The plot treated with cubé and Ultrawet yielded 130 U.S. bushels per acre more than the adjoining untreated plot.

Cauliflower plants to which the thrips migrated from onions killed by downy mildew were sprayed on 20th August, and counts were made on the following day. The temperature was relatively high. Cubé alone, with Aresket, with Ultrawet (1 : 1600) and with sulphur and Ultrawet gave 56, 65·4, 85·2 and 87·9 per cent. mortality, respectively.

List (G. M.). **Test of certain Materials as Controls for the Tomato Psyllid,** *Paratrioza cockerelli* **(Šulc), and Psyllid Yellows.**—*J. econ. Ent.* **31** no. 4 pp. 491–497, 6 refs. Menasha, Wis., August 1938.

Paratrioza cockerelli, Šulc, is a serious pest of tomato in Colorado, and lime-sulphur, though effective in its control [*R.A.E.*, A **23** 95], has not been extensively used on this crop, as it tends to injure the foliage. Sulphur dusts, however, exercise definite control [**23** 467] without apparent injury to the plants. Reports are here given of two experiments carried out in 1936, one designed solely to test the lethal effect of sulphurs and lime-sulphurs upon the Psyllid nymphs and the other to determine the comparative protection afforded and injury caused on one variety of tomato by certain of these materials in definite control programmes. The materials used in the test of lethal effect were liquid lime-sulphur (33° Baumé and 32·2 per cent. by volume sulphide sulphur) at a concentration of 1 : 49, a 300-mesh dusting sulphur and a 300-mesh gashouse dusting sulphur undiluted, and a 300-mesh wettable sulphur at the rate of 1 lb. to 10 U.S. gals. water. The applications were made on 10th September and counts taken 10 days later. The same materials were tested in the other experiment with the exception of the gashouse sulphur and the addition of dry lime-sulphur (70 per cent. calcium polysulphide) at the rate of 1 lb. in 10 U.S. gals. water. Applications were made on 26th June, 7th July and 11th August.

There was no significant difference in the lethal effect of the substances in either experiment. All gave high kills. Three applications were significantly more effective in controlling *P. cockerelli* and psyllid yellows caused by it than two, and the difference in favour of two as compared with one approached significance. Both lime-sulphurs seriously retarded plant growth and setting of fruit, and gave reduced yields as compared with untreated controls, but dusting and wettable sulphurs gave increased yields based on total weight of crop. The control of even a light infestation resulted in larger fruits. There was no significant difference in this respect between one and two applications, but three produced larger fruits than either. A moderate infestation of Psyllids stimulates flowering and fruiting. Significantly more fruits were produced on the control plots than on treated plots, and differences between treatments were highly significant, plots treated with lime-sulphur producing very few fruits, probably on account of plant injury.

FRIEND (R. B.), PLUMB (G. H.) & HICOCK (H. W.). **Notes on the European Pine Shoot Moth in Connecticut.**—*J. econ. Ent.* **31** no. 4 pp. 506–513, 6 refs. Menasha, Wis., August 1938.

Owing to the oviposition habits of the adults, the larval population of *Rhyacionia buoliana*, Schiff., on red pines [*Pinus resinosa*] up to 25 feet in height is concentrated at the tops of the trees [*R.A.E.*, A **21** 567]. The proportion of tips attacked and the number of larvae per tip decrease steadily from the terminals to the lower whorls of branches. The theory that the chances of a leading shoot being attacked are less in old than in young trees [**24** 754] does not hold in the case of *P. resinosa* in Connecticut. When trees are not crowded, a greater proportion of the tips on the lower branches becomes infested, but the trend of the distribution does not change. As a larva usually bores into one large bud or two small ones in the autumn and one shoot in the spring, chance of survival is less near the bottom of the tree, where buds are smaller and less numerous and where the dangers of migration are consequently greater. The tendency to attack the tips on the upper branches enables a small number of larvae to injure a tree seriously. When infestation is heavy, the upper whorls may fail to produce an average of one normal shoot each in the growing season.

Larval mortality during the winter is considerable, even when the temperature does not fall below 0° [F.]. It is more effective in reducing injury on lightly than heavily infested trees. The population of larvae on trees on which large numbers of buds have been destroyed, cannot increase much under any circumstances. In the absence of considerable parasitism, mortality of mature larvae and pupae was low and their numbers were a good criterion of adult emergence. The reproductive power of the females in the field is difficult to determine, but mortality before oviposition is completed or even begun appears to be high. In a shaded outdoor insectary, 10 females laid an average of 134 eggs each [but *cf.* **24** 754] and had 182 partly developed eggs in the ovarioles after oviposition ceased. The total number laid by any one female varied from 11 to 203. The largest number of eggs found in any female before oviposition was 590. Population increases rapidly in the field during the first few seasons, then much more slowly. Whether saturation point is reached or not depends on the height of the trees. If the trees are of such height that the stand closes before any injury has taken place, damage is usually negligible, but if an autumn population of 50–80 larvae per tree is reached by the time the trees are 6 feet high, damage to the trees may continue for some years after closure. Such a population may cause considerable injury to trees up to 25 feet in height.

The parasite most commonly found in Connecticut was *Hyssopus thymus*, Gir. [**24** 429], which feeds gregariously and externally on host larvae of all instars. It hibernates in the burrow of the host as a pupa and has several generations a year. At 24°C. [75·2°F.] and 60 per cent. relative humidity, the period from egg to adult lasted

17–18 days, and, with moist sugar available as food, several females lived five weeks. Pupae and adults have been taken in the field in May and during the summer, eggs and larvae in July and August, and pupae throughout the winter. Females were found more commonly than males. The percentage of injured tips containing parasites in five plantations examined between the autumn of 1936 and the spring of 1937 varied from 2·0 to 3·8, and in two other lightly infested plantations was 19, 10 trees in one plantation having a total of 27 living larvae of *R. buoliana* and 39 parasite pupae. A number of infested tips collected on 12th June 1937 from a plantation in which *Orgilus obscurator*, Nees, and *Cremastus interruptor*, Grav., two European parasites, were liberated in 1932 contained 113 living larvae and pupae ; 15 females and 1 male of *O. obscurator*, 3 males of *C. interruptor* and 4 cocoons of one of them were obtained from the larvae.

The extreme south-western part of the State continues to be the most generally infested. Of 11 plantations examined in 1933, and 182 in 1934, 30 and 89 per cent., respectively, had a heavy or medium infestation. The latter condition continued through 1935 and 1936, but in 1937, 193 plantations were examined of which half had heavy or medium infestations. A little further east, medium and heavy infestations were found in 37, 14, 19, 15 and 28 per cent. of the plantations examined in the years 1933–37, respectively. Infestation is much lower in the other parts of the State. In the north, this is attributed to low winter temperatures.

HAMILTON (C. C.). **Insecticides applied by Autogiro to control Cankerworms infesting Forested Areas.**—*J. econ. Ent.* **31** no. 4 pp. 513–518, 2 refs. Menasha, Wis., August 1938.

Reports are given of tests carried out in New Jersey in 1937 to determine the effectiveness of 10 different arsenical sprays and dusts applied by autogyro in killing larvae of *Alsophila pometaria*, Harr., and *Palaeacrita vernata*, Peck, on various deciduous trees in forested areas. The first females and egg masses of *P. vernata* were found on 5th March on dogwood [*Cornus*], and females of *P. vernata* and *A. pometaria* were found as late as 3rd April. The first larvae of both species were found on 5th May, and they were common but not abundant on the foliage of maple and ash on 10th May, when they were still in the first instar. Foliage was not sufficiently developed to justify treatment before this date and unfavourable weather prevented spraying before 15th May. The unevenness of infestation made it impracticable to compute efficiency by counts of larvae and frass collected on trays under the trees, and instead foliage was collected from the small trees forming the undergrowth of treated areas and taken to the laboratory, where larvae collected from untreated trees were allowed to feed on it. The number of dead larvae and weight of frass produced were recorded after 48 and 96 hours. The treatment that gave the highest kill was one consisting of 23 per cent. lead arsenate, 9 per cent. fish oil, 1 per cent. petroleum oil and 67 per cent. water applied at the rate of 10 U.S. gals. per acre on 26th May. This was much more effective than the same treatment applied 10 days earlier, when the spray did not adhere in an entirely satisfactory manner, and appreciably more effective than the same formula applied at 5 U.S. gals. per acre or at 10 U.S. gals. with calcium arsenate substituted for lead arsenate. The calcium arsenate did not adhere quite so well.

High kills were not recorded in any of the tests, as many of the larvae stopped feeding before taking a lethal dose. They gradually decreased in size, some of them changing to prepupae, but none pupating. On this account, the effectiveness of the materials was probably better compared by the reduction in feeding indicated by the quantity of frass produced. There was a marked decrease in feeding on foliage from all test plots and much less difference between the effectiveness of the materials calculated on this basis than on the basis of the kill. The treatment that gave the highest kill also gave the greatest reduction (87·4 per cent.), and the lowest kill and least reduction (67·5 per cent.) were given by 1¼ lb. of a colloidal lead arsenate (11 oz. dry lead arsenate) in 10 U.S. gals. water per acre. The lead arsenate and oil applied at 5 U.S. gals. per acre gave 82·2 per cent. reduction in frass, probably because the speed of the distributing blades was increased and finer particles and better distribution resulted. A mechanical mixture consisting of 53 per cent. lead arsenate, 25 per cent. Celite (a diatomaceous earth) and 22 per cent. petroleum oil applied at 40 lb. per acre gave 83·4 per cent. reduction in frass, but the physical properties of the dust were not as good as those of one previously used [*R.A.E.*, A **25** 684].

HAYES (W. P.) & DECOURSEY (J. D.). **Observations of Grasshopper Parasitism in 1937.**—*J. econ. Ent.* **31** no. 4 pp. 519–522, 7 refs. Menasha, Wis., August 1938.

An investigation of the parasites of nymphs and adults of grasshoppers in Illinois and Indiana was carried out in July–October 1937. The most effective was the fungus, *Empusa grylli*, which killed large numbers of adults, chiefly of *Melanoplus differentialis*, Thos., and *M. femur-rubrum*, DeG. Of 120 living adults of *M. differentialis* collected in Illinois on 11th October, 12 were infested with *E. grylli*. No Tachinids were found, with the exception of one larva doubtfully referred to this family. Parasitism by Sarcophagids was first noted on 9th July, when two first-instar larvae were found in two of 35 nymphs examined. Of 925 adults and 75 nymphs, mostly of *M. differentialis* and *M. femur-rubrum*, collected in Indiana in late August and early September, 18 adults and 4 nymphs were infested with 34 and 5 larvae, respectively, but of 50 adults collected in Illinois on 11th October, 10 were infested with 14 maggots. An attempt made to rear Sarcophagid larvae removed from dissected hosts by inserting them into an incision in the suture of the pleuron between the meso- and metathorax of another grasshopper and sealing the slit with paraffin wax was unsuccessful; the hosts lived only a few days, and no larvae were reared to the pupal stage, though they could be removed from dying individuals and transferred to fresh hosts. Methods by which Sarcophagid larvae and pupae may be distinguished from those of other Muscoid flies, and the three instars of cyclorrhaphous larvae from each other, are given. Of 12 adult Sarcophagids reared from grasshoppers taken in Illinois, 9 were *Sarcophaga reversa*, Aldr., and 3 *S. sinuata*, Mg. Of the 925 adults and 75 nymphs examined in August and September, 161 and 75 were infested with 412 and 24 mites (*Eutrombidium locustarum*, Walsh), respectively. None of the 50 adults examined in October carried mites. In the examination made in August and September, 129 adults and 17 nymphs, and in the October count, 1 adult were infested with Mermithids. Specimens were sent for identification, and those that were determinable were found to belong to the genus *Mermis*, with the exception of one *Hexamermis*. The species of *Mermis* was probably *M. subnigrescens*, Cobb.

Shotwell (R. L.). **Some Problems of the Annual Grasshopper Survey.** *J. econ. Ent.* **31** no. 4 pp. 523–533, 1 ref. Menasha, Wis., August 1938.

The following is substantially the author's summary of this paper in which some of the more important problems that have arisen in the course of making surveys of grasshopper populations in various parts of the United States by a method previously described by him [*R.A.E.*, A **23** 473] are discussed : In the general plan, three major kinds of survey are required, *viz.*, nymphal, adult and egg surveys. In the spring, there is a limited egg-survival survey, previous to and forming part of the nymphal survey, to determine the effect of drought, parasites and predators on the numbers of eggs. The nymphal survey is used as a check on the previous autumn survey to improve the accuracy of predictions. The adult and egg surveys are used for qualitative and quantitative studies of grasshopper populations from year to year and to locate and determine for the following year the extent of infestations and the quantities of materials needed for control. For this purpose, a larger area can be covered in a shorter time by the adult survey than by the egg survey, but the results are less dependable. It is harder to locate egg-pods than live grasshoppers ; therefore, the egg survey is slower, but the number of eggs is the real index of what is to be expected during the following year. The adult survey and the egg survey both have their advantages and disadvantages and must be adapted to varying conditions in different localities. Populations in the nymphal and adult surveys are estimated in numbers per square yard, by direct observation. In the egg survey, the numbers of egg-pods are estimated in numbers per square foot by counts made in favourable egg-laying places. There are four methods of sampling for egg-pods, each applicable to a particular condition. These are sifting unit quantities of soil taken to a depth of 3 inches ; shaving the surface of bare soil or sod and so exposing the tops of the egg pods for counting ; cutting out small unit areas of sod ; and digging or pulling single plants or clumps of grass for counts of pods per plant or clump, around or among their roots. The method to be used is chosen according to the egg-laying habits of the species present and the particular environment. The results of the adult and egg surveys are combined to determine the average percentage of infestation for each county, and bait requirements are estimated as 10 lb. dry material per acre for this percentage of the total area in crops susceptible to infestation by grasshoppers. In some cases, only certain proportions of the area under certain crops are included because of the character of the infestations in these crops, owing to cultural conditions and to the selective egg-laying habits of the species involved.

Bissell (T. L.). **The Host Plants and Parasites of the Cowpea Curculio and other Legume infesting Weevils.**—*J. econ. Ent.* **31** no. 4 pp. 534–536, 2 figs., 3 refs. Menasha, Wis., August 1938.

During a survey in central Georgia to ascertain the food-plants of *Chalcodermus aeneus*, Boh., more than 20 species of wild and cultivated leguminous plants were collected in 1936 and 1937. Records are given of the weevils and Bruchids obtained from the pods, showing the plants from which they were reared and their parasites. *C. aeneus* was taken from cowpeas, all the varieties examined being infested to varying degrees, and also from string beans and *Strophostyles umbellata* (wild bean). It was parasitised by *Myiophasia globosa*, Tns., and *Microbracon mellitor*, Say, was found in cowpeas infested with it.

Pechuman (L. L.). **A preliminary Study of the Biology of** *Scolytus sulcatus* **LeC.**—*J. econ. Ent.* **31** no. 4 pp. 537–543, 2 figs., 9 refs. Menasha, Wis., August 1938.

D. L. Collins states in a foreword that this study of the bionomics of *Scolytus sulcatus*, Lec., in New York was made with special reference to the possibility of its being concerned in the spread of the fungus [*Ophiostoma ulmi*] causing Dutch elm disease. With the exception of a doubtful record in 1928, it was not recorded between 1868, when it was originally described from New York, and 1933, when it was taken on elm in New Jersey. It was subsequently collected also in Connecticut and New York [*cf. R.A.E.*, A **24** 432, 524], and had been found in 17 counties of the latter state by 1937.

This Scolytid has been observed on the surface of felled elms and breeding in the weakened portions of living *Ulmus americana*, and has been reared experimentally on freshly cut elm logs. Apple is more frequently attacked in the field than elm, but they are attacked equally readily under experimental conditions. Slippery elm (*U. fulva*), *Sorbus americana* and peach are also attacked in the field. The adult is described.

Emergence begins in late May in south-eastern New York; it reached a peak in the first week of June in 1937, but continued until the third week of August. There were approximately equal numbers of males and females, but the males emerged first in all cases. Adults kept at 20°C. [68°F.] and provided with fresh elm twigs every 3 days fed continuously and lived up to 40 days, and those kept at 10°C. [50°F.] lived up to 78 days. Feeding, either in the form of twig feeding or feeding tunnels, appears to be necessary before eggs can be laid. The wounds made in twig feeding resemble those of *S. scolytus*, F., rather than those of *S. multistriatus*, Marsh., being on the sides of the twig as often as in the crotch, and broad and shallow. Frequently several beetles gather at one place and make one large wound. Wounds made by males and females are about equally extensive. Feeding tunnels, which are also made by both sexes, are short and largely in the bark, though they may reach the cambium. Some females construct four or five trial tunnels, short maternal tunnels in which a few eggs are laid and which are then deserted. Dying or weakened branches are usually used for breeding, though fresh wood may be attacked, and branches 6–15 inches in diameter seem to be preferred. The male apparently does not assist in the construction of the maternal tunnel. The tunnel, which follows an upward course, runs through the bark to the cambium and then between the bark and the wood. It may be from 5 to 100 mm. in length and 2 to 4 mm. in width. From 6 to 100 eggs, usually 40–60, are laid along the walls.

The larvae hatch in 5–10 days and tunnel between the bark and wood at right angles to the maternal tunnel. A completed larval gallery may measure 150–170 mm., but is usually shorter. Most of the larvae of most of the broods are full-fed towards the end of the summer and then construct chambers closed with frass at the ends of their tunnels. In these they hibernate and pupate in the following May. A few larvae of these broods, however, remain in their tunnels for the winter and either construct cells for pupation in the following spring or summer and emerge as adults in the same season or overwinter as larvae in cells and emerge as adults a year later than the other individuals of their brood. Larvae hatching late in the season also remain under the bark and continue their development in the following season. Observations indicated that the prepupal and pupal periods lasted 5–8 and 10–20 days, respectively, at the temperatures prevailing during May. In the laboratory at 25°C. [77°F.], they lasted 2–3 and 7 days. The adult remains in the cell for several days, then gnaws its way to the surface, sometimes through the frass-filled tunnel, but usually through a fresh opening. There was no evidence of more than one generation annually, though the production of two would appear to be possible.

The most important natural enemies are woodpeckers. Competition with other Coleopterous borers exercises a controlling influence, particularly in elm. There has been little opportunity of studying the importance of parasites and insect predators.

CRANDELL (H. A.). **A Cage for rearing the Cheese Skipper,** *Piophila casei* **L.**—*J. econ. Ent.* **31** no. 4 pp. 544–545, 2 figs. Menasha, Wis., August 1938.

Larvae of *Piophila casei*, L., when mature, commonly leave the substratum on which they have been developing to pupate elsewhere. A cage designed to take advantage of this habit and automatically collect the migrant larvae is described. It is thought that it may be useful for rearing other Diptera with similar habits.

HATCH (M. H.). **The Furniture Beetle,** *Anobium punctatum* **DeG., in Washington.**—*J. econ. Ent.* **31** no. 4 p. 545. Menasha, Wis., August 1938.

Anobium punctatum, DeG., a widely distributed pest of woodwork in Europe, which has hitherto been recorded from only a few scattered localities in North America, all of them in the east, has been found damaging the woodwork of a house in Seattle, western Washington.

ROARK (R. C.). **Discussion of the Term "Derris Resinate."**—*J. econ. Ent.* **31** no. 4 p. 545. Menasha, Wis., August 1938.

The author points out that a resinate is a salt or ester of a resin acid and that the term derris resinate was used in a recent paper [*R.A.E.*, A **26** 574] where derris extract was meant.

FULTON (R. A.). **Sulfur Nitride as a possible Insecticide and Fungicide.**—*J. econ. Ent.* **31** no. 4 pp. 545–546, 1 ref. Menasha, Wis., August 1938.

During the period 1935–37, the insecticidal properties of sulphur nitride were tested in the laboratory on *Epilachna varivestis*, Muls. The pure compound was one-third as toxic to it as pure rotenone and twice as toxic as a commercial calcium arsenate or thiodiphenylamine (phenothiazine). A laboratory preparation containing 30 per cent. sulphur nitride caused no visible injury to bean foliage when ground with an equal weight of talc or bentonite and applied in water at the rate of 1½ lb. of the mixture (0·2 lb. pure sulphur nitride) to 50 U.S. gals. Sulphur nitride exists as orange-red crystals melting at 178–180°C. [352·4–256°F.]. It is soluble in a few organic solvents and liquid ammonia but not in water. In practically all the methods proposed for its preparation the substances produced also include sulphur. These mixtures of sulphur and sulphur nitride do not detonate when struck with a hammer or when ground with talc or bentonite, whereas pure sulphur nitride does detonate when struck.

HIXSON (E.). **Variation in the Susceptibility of Brambles to the Red-necked Cane Borer,** *Agrilus ruficollis* **(F.).**—*J. econ. Ent.* **31** no. 4 p. 546. Menasha, Wis., August 1938.

Agrilus ruficollis, F., is a major pest of blackberries and dewberries in Oklahoma. The larvae girdle the cane, usually near the base, producing a gall, above which the cane usually dies. Varieties differ greatly in susceptibility. In an examination of 17 varieties made on 18th March 1938, the percentage infestation varied from 0 to 72. Prostrate and semi-prostrate varieties seemed to be preferred, though one extremely small variety was not infested.

HIXSON (E.). *Paratrioza cockerelli* **(Šulc) in Oklahoma.**—*J. econ. Ent.* **31** no. 4 p. 546. Menasha, Wis., August 1938.

An outbreak of *Paratrioza cockerelli*, Šulc, was observed on tomatos in a greenhouse at Stillwater, Oklahoma, in March 1938. The Psyllids were readily controlled by a spray of lime-sulphur (1 : 45) which, however, left a residue on the fruit that was most difficult to remove with either a wet or a dry cloth.

ASQUITH (D.). **The Common Red Spider and Carnation Rust.**—*J. econ. Ent.* **31** no. 4 pp. 546–547. Menasha, Wis., August 1938.

In preliminary observations in Massachusetts on the connection between *Tetranychus telarius*, L., on carnation plants and the dissemination of the carnation rust fungus, *Uromyces caryophyllinus*, it was shown that the mites usually enter the rust pustules on carnation leaves. In two lots of 97 and 77 mites taken from leaves having rust pustules, 17 and 23, respectively, carried the uredospores of the fungus.

DAVIS (A. C.). *Tarsonemus* **spp. attacking Mushrooms.**—*J. econ. Ent.* **31** no. 4 p. 547. Menasha, Wis., August 1938.

During 1936 and 1937, two species of *Tarsonemus* were found attacking the crop in commercial mushroom houses in the United States, *T. floricolus*, C. & F., in small numbers in Maryland in 1936 and in very large numbers near Chicago, Illinois, in 1937, and an undescribed species in Pennsylvania in the autumn of 1936 and the spring and autumn of 1937. F. F. Smith collected *T. floricolus* from Japanese iris in New York in 1934.

FROST (S. W.). **Notes on Wettable Sulfurs.**—*J. econ. Ent.* **31** no. 4 p. 547, 2 refs. Menasha, Wis., August 1938.

The different forms of wettable sulphur, which is in general use for spraying peach and other stone fruit, vary in the percentage of sulphur, the adulterants or fillers and the wetting agents they contain. In the newer types, the sulphur-content has been raised to as much as 98·5 per cent., whereas in some of the older ones it was only 30 per cent. In all cases, the percentage of wetting agent is small. The sulphur-content of 100 U.S. gals. of spray prepared from various forms diluted according to recommendation is shown and varies from 1·8 to 7·6 lb.

BUSHNELL (R. J.). **The Relation of Nutritional Levels to the Growth of Populations of *Tribolium confusum* Duval. I. Growth of larval, pupal, and adult Populations in Cornmeal and in Cornmeal supplemented with Yeast.**—*Ann. ent. Soc. Amer.* **31** no. 3 pp. 345–351, 1 fig., 15 refs. Columbus, Ohio, September 1938.

The addition of yeast to yellow maize-meal improved it as a medium in which to culture *Tribolium confusum*, Duv., increasing the egg-production as indicated by records of young larvae, the rate of larval growth, the percentage of individuals surviving pupation and the adult population per gram of culture-medium.

BRADLEY (W. G.) & ARBUTHNOT (K. D.). **The Relation of Host Physiology to Development of the Braconid Parasite, *Chelonus annulipes* Wesmael.**—*Ann. ent. Soc. Amer.* **31** no. 3 pp. 359–365, 1 fig., 4 refs. Columbus, Ohio, September 1938.

Chelonus annulipes, Wesm., a parasite of *Pyrausta nubilalis*, Hb., now established in the United States [*cf. R.A.E.*, A **21** 237], was reared on *P. penitalis*, Grote, and *Ephestia kuehniella*, Zell., as well as the two- and one-generation strains of *P. nubilalis*, during observations covering several years in Massachusetts and Ohio. The Braconid was found to adapt its development closely to that of its host. Although under natural conditions in the United States larvae of the one-generation strain of *P. nubilalis* are large enough for the larvae of *C. annulipes* to have completed their development early in August, when adults are emerging from parasitised two-generation hosts [*cf.* **20** 478], the parasite larvae in them have never developed beyond the first instar at this time, and it is evident that the physiological condition of the host does not promote development of the parasite until the former has passed through the diapause without which it cannot mature. In experiments at 80°F. and 70 per cent. relative humidity, no first-, second- or third-instar larvae of *C. annulipes* were noticed in the two-generation strain of *P. nubilalis* more than 15, 17 and 19 days after oviposition, respectively, and the life-cycle occupied about 30 days, whereas in the one-generation strain, no second- or third-instar larvae were noticed before the 20th and 24th day after oviposition, and there were still some first-instar ones 36 days after oviposition ; the developmental period varied greatly in total length. Synchronisation was obtained between the development of *C. annulipes* on the one hand and *P. penitalis* and *E. kuehniella* on the other, the life-cycle on these hosts occupying about 30 and 44 days, respectively. The larvae of *C. annulipes* never pass beyond the first instar until the host has ceased feeding.

Haug (G. W.). **Mass Egg Production by the Coccinellid** *Hippodamia convergens* **Guer.**—*Ann. ent. Soc. Amer.* **31** no. 3 pp. 366–368, 1 pl., 2 refs. Columbus, Ohio, September 1938.

Satisfactory egg production by *Hippodamia convergens*, Guér., can be maintained throughout the year by the use of frozen Aphids [*R.A.E.*, A **26** 649]. However, it is more convenient to use living Aphids when they are available. In 1935 and 1936, experiments were carried out in Ohio on the methods of obtaining the best oviposition with living Aphids as food. Adults produced eggs when fed on any of a number of different Aphids, including all those already noticed [*loc. cit.*], but *Pemphigus populi-transversus*, Riley, and *P. populicaulis*, Fitch, were much the most satisfactory. Only one of the Aphids tried, an undetermined woolly aphis from elm, would not support egg production.

The Aphids are collected by the gallon and stored at 2°C. [35·6°F.] under high humidity. In the case of gall Aphids, the galls are clipped from the leaves and packed loosely in waxed containers in which is some saturated cellucotton and which have a small hole in the lid for aeration. The best cage for the Coccinellids is half a Petri dish covered with butter muslin stretched between two aluminium hoops. The source of light is below the cage [**26** 650], and humidity is kept high to prevent desiccation of the Aphids. The cages are cleaned and the beetles fed twice daily, and a piece of cellucotton saturated with water provides moisture. An excess of food is always given. A supply of leaves of *Spiraea* is kept for the females to oviposit on. As overwintering females retain their fertility of the previous season, males are not kept in the cages, where they consume valuable food and interfere with oviposition. Between 6th and 15th July 1936, 17,933 eggs were laid by a daily average of 35 overwintered females that had been used for egg production for some time previously.

Babers (F. H.). **A Septicemia of the Southern Armyworm caused by** *Bacillus cereus*.—*Ann. ent. Soc. Amer.* **31** no. 3 pp. 371–373, 2 refs. Columbus, Ohio, September 1938.

Bacillus cereus, the most common spore-forming bacterium in the soil, was isolated from larvae of *Xylomyges* (*Prodenia*) *eridania*, Cram., affected with an epidemic disease that caused high mortality while they were being reared in greenhouse cages for use in experiments on insect physiology. Hypodermic injections of pure sub-cultures resulted in the death of all inoculated larvae within 72 hours, and bacteria recovered from some of these just before they died and used to inoculate other larvae again caused total mortality. The symptoms of the induced and natural diseases were the same. Attempts to infest larvae by allowing them to feed on plants wet with broth cultures of the bacteria, dipping them in the cultures or enclosing them with inoculated larvae were unsuccessful. The normal method of transmission of the disease is unknown. Injections of the culture killed cockroaches (*Periplaneta americana*, L.) in 96 hours. Blood counts of diseased larvae of *X. eridania* showed a marked reduction in the number of cells present. A description of the isolated organism is given. The disease seems to be effectively controlled by washing the cages with cresol at intervals of 10 days, washing the sand at the bottom with water and sterilising it by heating at 180°C. [356°F.] and avoiding overcrowding, since there has been no recurrence of the outbreak.

ARANT (F. S.). **Life History and Control of the Cowpea Curculio.**—*Bull. Ala. agric. Exp. Sta.* no. 246, 34 pp., 14 figs., 27 refs. Auburn, Ala., May 1938.

The following is based on the author's summary of this paper, which records the results of investigations carried out in Alabama in 1930–36, some of which have already been noticed [*R.A.E.*, A **20** 607 ; **23** 414 ; **26** 572, 691] : *Chalcodermus aeneus*, Boh., occurs throughout the coastal states from North Carolina to Texas, where it is a major pest of cowpeas (*Vigna sinensis*). In Alabama, the infestation of leading garden varieties averaged 36 per cent. in 1930–32, and in some cases exceeded 65 per cent. The adults also feed on beans, cotton and other crops, chiefly before cowpeas are available, and the larvae develop in the seeds of string beans (*Phaseolus vulgaris*) as well as cowpeas [*cf.* **27** 77].

Two generations occurred annually in cowpeas. The eggs were laid in the pod or in the seed inside. The larvae, when mature, emerged from the dry pod to pupate in the soil ; they did not survive in pods stored on a dry concrete floor. The adults hibernated under rubbish or in the soil ; some mortality was observed, which may have been due to a fungus. The larvae were parasitised by the Tachinid, *Myiophasia globosa*, Tns., and were frequently killed by ants when attempting to enter the soil. Hot dry weather was the chief climatic factor in natural control. Garden varieties of cowpeas varied in their resistance to attack, but it is doubtful if any would escape serious injury in the absence of more susceptible varieties.

The adults are difficult to control because they normally feed within the pods. The percentages of control obtained by dusting with calcium arsenate, sodium fluosilicate, magnesium arsenate and acid lead arsenate were 74·53, 67·11, 61·57 and 50·93, respectively ; calcium arsenate and acid lead arsenate scorched the foliage severely. Dusting with sodium fluosilicate was the most satisfactory method and should give 70–75 per cent. control under farm conditions.

HEISS (E. M.). **A Classification of the Larvae and Puparia of the Syrphidae of Illinois exclusive of Aquatic Forms.**—*Illinois biol. Monogr.* **16** no. 4 142 pp., 146 figs., 4 pp. refs. (*Univ. Illinois Bull.* **36** no. 1.) Urbana, Ill., 30th August 1938. Price $1·50.

This study of the Syrphids of Illinois, excluding aquatic forms, contains descriptions of the larvae and puparia of the various species, with keys. Notes are given on the feeding habits of the larvae, including records of the Aphids attacked by those that are predacious, and a list of their Hymenopterous parasites is appended.

DELONG (D. M.). **Biological Studies on the Leafhopper** *Empoasca fabae* **as a Bean Pest.**—*Tech. Bull. U.S. Dep. Agric.* no. 618, 60 pp., 41 figs., 60 refs. Washington, D.C., June 1938.

This bulletin contains the more important data and conclusions obtained during a study of *Empoasca fabae*, Harr., carried out chiefly during 1926–30 and dealing with its bionomics in Ohio, with particular reference to its occurrence as a pest of beans there, and with its distribution in the United States as a whole. Investigations on this leafhopper are reviewed from the literature, and notes are given on its synonymy and characters, and the characters of allied species of *Empoasca* that have been confused with it, this confusion having led to erroneous records of its distribution in the west of the United States and of its feeding on wild plants in early spring in the east [*cf. R.A.E.*, A **19** 489]. The injury it causes to each of its more important food-plants is described. Its abundance and distribution, and the distribution of the other species of *Empoasca* injurious in the United States, particularly in relation to climatic and physical factors, are discussed in detail. The rest of the paper (pp. 27–56) comprises a full account of the studies on its biology, the salient features of which, as mentioned in the author's summary, have already been noticed [**16** 399 ; **23** 468]. Its distinctness from *E. abrupta*, DeLong, was confirmed by experiments in which no progeny resulted when attempts were made to pair the two species, and different types of economic injury were consistently produced by each [*cf.* also **19** 687]. The examples of *E. abrupta* used in these experiments were of Californian origin ; California was the only western state in which *E. fabae* was found, and it occurred there only at low altitudes and in small numbers.

PARKS (T. H.). **Ohio Wheat Field Insect Survey for 1938.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **23** no. 194 pp. 172–174, 2 maps. Wooster, Ohio, 1938.

In 1938, infestation of wheat by the Hessian fly [*Mayetiola destructor*, Say] in Ohio increased, particularly in the north-west. The average infestation was 10 per cent. [*cf. R.A.E.*, A **26** 130], but in some of the fields in the north-west, up to 91 per cent. of straws were infested. General observance of correct sowing dates is recommended ; a map shows the dates for the various parts of the state.

HOUSER (J. S.). **The Black Wheat-stem Sawfly.**—*Bi-m. Bull. Ohio agric. Exp. Sta.* **23** no. 194 pp. 174–175, 1 map. Wooster, Ohio, 1938.

Infestation of wheat in Ohio by the black wheat-stem sawfly [*Trachelus tabidus*, F.] in 1938 declined sharply in areas which had been heavily infested previously, and spread very little [*cf. R.A.E.*, A **26** 130]. There was some indication of control by parasites.

DYKSTRA (T. P.) & WHITAKER (W. C.). **Experiments on the Transmission of Potato Viruses by Vectors.**—*J. agric. Res.* **57** no. 5 pp. 319–334, 5 figs., 24 refs. Washington, D.C., 1st September 1938.

The following is taken from the authors' discussion of experiments carried out in Oregon between 1929 and 1936 on the transmission by insects of virus diseases of potatoes : The four Aphids tested, *Macrosiphum solanifolii*, Ashm., *M. solani*, Kalt. (*Myzus pseudosolani*, Theo.), *Myzus persicae*, Sulz., and *M. circumflexus*, Buckt., can all serve as vectors of leaf-roll, rugose mosaic, crinkle mosaic and mild mosaic. *Macrosiphum solanifolii* did not transmit leaf-roll so readily as the other Aphids. It fed in the vascular tissue in only 46·7 per cent. of the cases observed, whereas the other species habitually did so. The latter differed little in their ability to transmit the disease, which may be related to their feeding in the phloem. They often failed to transmit mosaic when colonised on potato plants infected with both mosaic and leaf roll. Physiological factors may influence the virus within the Aphid and thus account for the apparent inconsistencies in the transmission of viruses by these three species. The percentage of transmission of the mosaic viruses was much higher when the Aphids had continuous access to the diseased and healthy plants than when they were transferred directly, which suggests that the viruses may survive only a short time in the Aphids. Mild mosaic and crinkle mosaic were occasionally transmitted from potato to tobacco by *M. solanifolii*, *M. solani* and *Myzus circumflexus*. Five Aphids per plant were sufficient to cause infection.

Epitrix subcrinita, Lec., *Lygus pratensis*, L., *Empoasca filamenta*, DeLong, and *Philaenus leucophthalmus*, L., which feed naturally on potatoes, failed in three years' testing to show transmission of any of the viruses studied.

BRUNSON (M. H.). **Influence of Japanese Beetle Instar on the Sex and Population of the Parasite** *Tiphia popilliavora.*—*J. agric. Res.* **57** no. 5 pp. 379–386, 4 refs. Washington, D.C., 1st September 1938.

The main conclusions reached during investigations carried out in New Jersey in 1931–35 on the relation between *Tiphia popilliavora*, Roh., and the three larval instars of its host, *Popillia japonica*, Newm., have already been noticed [*R.A.E.*, A **22** 415 ; **25** 678]. The evidence showed that a variation in the relative number of third-instar host larvae present in August, when the adult parasites are active, and also in the total host population tends to cause a variation in the parasite population at different colony points. A gradual or marked decrease in the number of host larvae in the third instar at all colony points at intervals of several years explains the marked reduction in the parasite population at similar intervals.

WOLCOTT (G. N.). **Description and Biologic Notes on a** *Tiphia* **(Hymenoptera : Scoliidae) from Haiti.**—*J. Dep. Agric. Puerto Rico* **22** no. 2 pp. 189–192, 4 refs. Rio Piedras, P.R., April 1938.

Descriptions are given of both sexes of *Tiphia hispaniolae*, sp. n., which is a common parasite of the larvae of May beetles [*Lachnosterna*] in Haiti and is thought to be responsible for their normal scarcity in cultivated fields there [*cf. R.A.E.*, A **16** 436]. Adults of this Scoliid were generally larger and more numerous at high altitudes ; they commonly fed at the flowers of wild parsnip or on the honey-dew on leaves of guava infested by *Coccus viridis*, Green. In Haiti, the species of *Lachnosterna* vary greatly in size, but it is considered possible that the female of *T. hispaniolae* attacks the larvae of most or all of them when they are in different instars of approximately the same size. No other species of *Tiphia* has been found in Haiti.

Wolcott (G. N.). **The Introduction into Puerto Rico of** *Larra americana* **Saussure, a specific Parasite of the "Changa" or Puerto Rican Mole-cricket** *Scapteriscus vicinus* **Scudder.**—*J. Dep. Agric. Puerto Rico* **22** no. 2 pp. 193–218, 4 figs., 16 refs. Rio Piedras, P.R., April 1938.

Wolcott (G. N.). **Presence of Host keeps Parasite alive in Captivity.**—*Science* **87** no. 2259 p. 352. New York, N.Y., 1938.

In the first paper, an account is given of attempts in 1936–38 to introduce *Larra americana*, Sauss., into Porto Rico against *Scapteriscus vicinus*, Scud., of which the bionomics and control are briefly discussed [*cf. R.A.E.*, A **26** 40]. This Sphegid is a specific ectoparasite of the mole-cricket. A preliminary search in Trinidad showed that though the cricket was abundant in open sandy areas, it was not parasitised. The Sphegid was numerous, however, at Belem, north-eastern Brazil, and subsequent investigations showed it to be present near Paramaribo, Dutch Guiana, and, in small numbers, near Caripito, Venezuela, but as its introduction into Porto Rico from these localities would be at least as difficult as from Belem, further investigations in them were not made. It was not observed in a local search in British Guiana or in Haiti, though the cricket occurred in both, its distribution in the latter being limited by the comparative absence of sandy areas. The introduction of the parasite was therefore attempted from Belem, and adults were sent to Porto Rico by aeroplane. The 25 liberated in Porto Rico in 1936 [*cf.* **26** 223] did not survive, owing to a three months' drought; daily rains are necessary for survival. In 1937, only 28 of a total of 262 dispatched from Brazil arrived alive, the mortality in captivity being much greater at the end of the wet season than at its beginning. In 1938, a number of crickets on which the wasps had oviposited in the laboratory were shipped together with the adult parasites, and both showed a very low rate of mortality. Of 59 adult parasites transported by this method, 45 survived, as also did 95 of 121 parasitised crickets; 79 of these were released together with adult parasites. The other crickets were kept in the laboratory at 72–78°F., and though larvae hatched from all the eggs of the parasite, only one pupated and no adults were obtained.

During the wet season, the females of *L. americana* observed in Brazil normally explored tunnels of *Scapteriscus* in the early morning in search of hosts on which to oviposit. When the sun had somewhat dried the ground and was at its hottest, they fed, at the beginning of the wet season (January–February), on the nectar of *Borreria verticillata*, and at its end (May), when they were commonest, on that of *Hyptis atrorubens*. *Borreria* is common in Porto Rico throughout the range of *Scapteriscus*.

In the second paper, it is pointed out that the parasites transported in 1938 were kept alive by the mere presence of the hosts, as they were prevented from coming into actual contact with them. This phenomenon does not appear to have been recorded previously from any known parasite.

Waterston (J. M.). **The Japanese Beetle.**—*Agric. Bull. Bermuda* **17** no. 8–9 pp. 42–48. [Hamilton] 1938.

In July and August 1938, numerous adults of *Popillia japonica*, Newm., invaded boats plying between New York and Bermuda, both while in dock at New York City Harbour and while proceeding down the New Jersey coast. On arrival at Bermuda, a thorough search revealed no living beetles, but many dead ones. Since the voyage takes only two days, the introduction of *P. japonica* into Bermuda in a viable condition is considered likely. In view of this, an account is given of its bionomics and spread in the United States and the methods employed for its control there. Modifications of the quarantine regulations in Bermuda are suggested to reduce the risk of its introduction.

Pyenson (L.). **The Problems of Applied Entomology in Pernambuco, Brazil.**—*Rev. Ent.* **8** fasc. 3–4 pp. 237–254, 1 map, 2 charts, 4 refs. ; **9** fasc. 1–2 pp. 16–31, 11 refs. Rio de Janeiro, 25th June and 27th September 1938.

In the first part of this paper, the author surveys the physiography of the state of Pernambuco, Brazil, and gives brief notes on the flora and the ecological conditions governing insect life in it. Conditions are primitive in a great part of the state, and very little work against insect pests has been carried out. The second part contains brief preliminary notes on a large number of pests that have been observed on the various crops, of which the most important are sugar-cane and cotton.

Cushman (R. A.). **A new Species of *Calliephialtes* from Brazil, with a Key to the Neotropical Species (Hymenoptera : Ichneumonidae).** —*Rev. Ent.* **9** fasc. 1–2 pp. 11–13. Rio de Janeiro, 27th September 1938.

The new species is *Ephialtes* (*Calliephialtes*) *dimorphus* ; descriptions are given of both sexes, reared from *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in São Paulo.

Mendes (L. O. T.). **Lista dos inimigos naturaes de *Dysdercus* spp., observados no Estado de São Paulo.** [List of the natural Enemies of *Dysdercus* spp. observed in the State of São Paulo.]—*Rev. Ent.* **9** fasc. 1–2 pp. 215–217, 7 refs. Rio de Janeiro, 27th September 1938. (With a Summary in English.)

This list of natural enemies of cotton stainers (*Dysdercus* spp.) in São Paulo comprises the ten Dipterous parasites already recorded [*R.A.E.*, A **25** 678 ; **27** 22], a mite ectoparasitic on *Dysdercus mendesi*, Blöte, and *D. ruficollis*, L., and a fungus of the genus *Empusa* destroying *D. honestus*, Blöte, and *D. ruficollis*. The most important is *Acaulona brasiliana*, Tns., which parasitises *D. honestus* and *D. ruficollis* and, to a less extent, *D. mendesi*. Parasitism by it ranging up to 50 per cent. has been observed.

Da Fonseca (J. P.). **A cochonilha branca dos pessegueiros e das amoreiras.** [The White Scale of Peach and Mulberry.]—*O Biologico* **4** no. 8 pp. 262–266, 9 figs. S. Paulo, August 1938.

Brief descriptions are given of the stages and life-cycle of *Aulacaspis* (*Pseudaulacaspis*) *pentagona*, Targ., which attacks a variety of plants in São Paulo, including fruit trees and cotton. The usual sprays are suggested for control, but it is recommended that they should not be applied if parasites of the scale are active. Those occurring in São Paulo are *Prospaltella berlesei*, How., which was introduced in 1920 and is now widely distributed, and *Aphytis* (*Aphelinus*) *diaspidis*, How., which is found throughout Brazil, where it parasitises various Coccids.

GOETSCH (W.). **Untersuchungen über die Bekämpfungsmöglichkeiten argentinischer Blattschneider-Ameisen.** [Investigations on the Possibilities of Control of Argentine Leaf-cutting Ants.]—*Tropenpflanzer* **41** nos. 9–10 pp. 385–413, 443–461, 11 figs., 13 refs. Berlin, September–October 1938.

The author discusses from the literature and his own observations in several regions of Argentina the habits and control of leaf-cutting ants of the genera *Atta* and *Acromyrmex*. He concludes that there is no simple method of destroying a whole nest, since the immature stages deep in the nest are usually inaccessible to control measures, including fumigation, and treatment must therefore be repeated after 2–3 weeks. He suggests that effective control would result from a combination of fumigation, scattering poisons near the entrances to nests, and poison baits. The latter should not always consist of sugary substances, as these are soon neglected ; preparations of meat extract or albumen should also be offered.

LIZER Y TRELLES (C. A.). **Cochinillas exóticas introducidas en la República Argentina y daños que causan.** [Exotic Coccids introduced into Argentina and the Injury they cause.]—*Jornadas agrón. vet.* November 1937 pp. 341–362, 28 refs. Buenos Aires, reprint 1938.

A list is given of over 50 Coccids of foreign origin recorded in Argentina, with notes on their distribution, food-plants and synonymy. The 12 species of economic importance are also briefly discussed separately.

VEITCH (R.). **Insect Pests and their Control.**—*Qd agric. pastoral Handb.* **3** pp. v–vii, 1–116, 248–250, 30 pls. Brisbane, 1938.

The chief aim of the part of this handbook under review is to provide a simply worded outline of the control measures to be used against the more important pests of Queensland crops other than sugar-cane. A preliminary chapter contains information on the principal insecticides and their use. The pests and their life-histories are then described, and notes on the damage they cause and the appropriate control measures are given. They are grouped as fruit pests, agricultural and grassland pests, vegetable pests, and general and household pests.

LEECE (C. W.). **Mosaic Disease of Sugar Cane.**—*Qd agric. J.* **50** pt. 2 pp. 185–188, 1 pl. Brisbane, August 1938.

Mosaic disease of sugar-cane, the characteristic symptoms of which are described, is widespread in central and southern Queensland, its severity varying with the variety of cane. A list is given of susceptible and resistant varieties. The vector of the disease is *Aphis* *maidis*, Fitch, which breeds on maize, but not on sugar-cane. The Aphid is commonest in summer and autumn and readily feeds on young canes planted in spring, young canes being more easily infected than older ones. In addition to maize, *Sorghum* and other grasses may be infected and serve as a source of infection of sugar-cane. Preventive measures consist in eliminating diseased stools, selecting healthy planting material, keeping fields free from weeds, planting in autumn and selecting resistant varieties of cane. Maize should not be grown in close proximity to sugar-cane.

MUNGOMERY (R. W.). **Cane Grub Control in the Isis District.**—*Qd agric. J.* **50** pt. 2 pp. 242–243. Brisbane, August 1938.

Observations in a district in Queensland early in 1938 showed no increase in infestation of sugar-cane by Lamellicorn larvae. This is considered to be due partly to the elimination of spring planting, but mainly to the destruction of the larvae during cultivation of the soil with high-speed rotary hoes. This operation is carried out twice during the summer, at an interval of 6–8 weeks, and when the soil is moist, as the grubs then come up nearer the surface. Cane planted in February, after hoeing, generally remains reasonably free from infestation until the second ratoon crop.

KNUST (H. G.). **Grub Control in the Burdekin District, 1937–8.**—*Qd agric. J.* **50** pt. 2 pp. 244–245. Brisbane, August 1938.

Observations in a district in north-eastern Queensland in 1937–38 indicated that repeated heavy watering of sugar-cane lands did not appear to affect the time of adult emergence of the greyback beetle [*Lepidoderma albohirtum*, Waterh.]. Collecting the beetles by hand is impracticable, as the trees on which they feed are very numerous in this district. Soil fumigation was undertaken during the year, as the larvae were abundant, occurring at average rates of 3–14 per stool, but it requires careful supervision for the following reasons : some soils crack quite soon after rain, and water then has to be applied to make them suitable for fumigation ; the application of water to the furrows between the rows of cane tends to retard the concentration of the grubs at the bases of the stools ; and where the grubs concentrate, they feed 4–10 ins. below the surface of the soil, because it has been heaped against the stools to create the water furrows.

BUZACOTT (J. H.). **French's Cane Beetle.**—*Qd agric. J.* **50** pt. 2 p. 246. Brisbane, August 1938.

The effects of fumigation on the growth of sugar-cane infested by larvae of *Lepidiota frenchi*, Blkb., were further investigated in Queensland in 1937–38 [*cf. R.A.E.*, A **21** 151, etc.]. Treatment with carbon bisulphide caused no injury to infested stools, but did not stimulate their growth, while the plants were injured by mixtures of carbon bisulphide and ortho- or paradichlorbenzene. Fumigation is not considered a practicable method of controlling *L. frenchi*, as it would be necessary to dig deeply before the damage began to show in order to determine what parts of the field should be fumigated, and, even if this were done, the erratic way in which larvae of this species come up from the deeper layers of the soil to resume feeding would render the results of fumigation doubtful. This is particularly true of dry years, while in years of well distributed rainfall, the cane can make roots quickly enough to withstand infestation by the grubs.

WARD (K. M.). **Codling Moth Control Experiments.**—*Qd agric. J.* **50** pt. 2 p. 253. Brisbane, August 1938.

In further tests on the control of codling moth [*Cydia pomonella*, L.] on apple and pear in Queensland [*cf. R.A.E.*, A **26** 149] carried out in 1937–38, three spray schedules proved as effective as one in which lead arsenate was used for both calyx and cover sprays. These were: a calyx spray of 2½ lb. lead arsenate in 50 gals. water with a spreader followed by cover sprays of 1⅓ gals. white oil in 80 gals. water; a calyx and cover sprays of 1 pint nicotine sulphate and 1⅓ gals. white oil in 80 gals.; and a calyx and cover sprays of 1 pint nicotine sulphate and 1 quart white oil in 80 gals. There were indications, however, that the last two formulae would have been even more effective as cover sprays following a calyx spray of lead arsenate. The third formula, in which the quantity of oil is only sufficient to facilitate spreading of the nicotine sulphate, is new and requires further testing before it can be recommended. Potash soft soap (10 lb. in 80 gals. water) used for calyx and cover sprays gave no protection. Cover sprays should usually be applied 5–12 days after peaks of moth activity, which may be determined by means of traps containing 1 part vinegar or molasses in 12 parts water.

SMITH (J. H.). **White Ants as Pests of Fruit Trees.**—*Qd agric. J.* **50** pt. 2 p. 254. Brisbane, August 1938.

Considerable damage to fruit trees in Queensland, particularly in irrigated inland areas, is sometimes caused by termites. Infestation in *Citrus* trees and vines generally escapes attention until yellowing of the foliage and lack of vigorous new growth are apparent. The removal of trees, stumps and roots on the site of proposed new orchards is an essential preventive measure. For the control of infestations in established trees having diameters of over 2 ins., a small quantity of Paris green should be blown into the termite tunnels through holes (¼ or ⅜ in. in diameter) bored in the trunk at various heights, which should then be plugged with wax [*cf. R.A.E.*, A **18** 105]. In the case of young trees or vines, which are attacked more or less superficially on the stem just below the ground, two or three inches of soil should be removed from the base, and the runways, which are built over the bark, should be destroyed by hand. A little Paris green should be blown in the vicinity to impregnate any runways linking with the parent nest. The base of the plant should be left exposed.

Damage to herbaceous plants may be reduced by placing crystals of paradichlorobenzene in the soil in ⅛ oz. doses at a depth of 4 ins. at least 18 ins. apart and 12 ins. from the plant.

FYFE (R. V.) & GAY (F. J.). **The Humidity of the Atmosphere and the Moisture Conditions within Mounds of *Eutermes exitiosus* Hill.**—*Pamphl. Coun. sci. industr. Res. Aust.* no. 82, 9 diagr., 19 refs. Melbourne, 1938.

The following is taken from the authors' summary: A study of the humidity of the atmosphere within mounds of the termite, *Eutermes* *exitiosus*, Hill, was made in Australia, as humidity is known to be an important factor affecting termites kept under artificial conditions in the laboratory. The results indicated that the relative humidity of the atmosphere within mounds is rarely less than 92 per cent., in spite of seasonal changes of temperature in them.

Pescott (R. T. M.). **The Potato Moth.**—*J. Dep. Agric. Vict.* **36** pt. 9 pp. 441–442, 5 figs. Melbourne, September 1938.

Phthorimaea operculella, Zell., is present in every potato-growing district in Victoria. In hot dry seasons, injury may amount to 60 per cent. in early crops and 25–40 per cent. in mid-season and late crops. A brief account is given of the way in which infestation occurs. The control measures suggested include sowing the seed potatoes at a depth of at least 4 ins., keeping the tubers covered with earth during the growing period, prompt bagging and removal of the crop after digging, and the destruction of solanaceous weeds.

van Zwaluwenburg (R. H.). **Trapping Sugar Cane Beetle Borers at Kailua.**—*Hawaii. Plant. Rec.* **42** no. 3 pp. 167–173, 3 figs. Honolulu, 1938.

Traps for the control of *Rhabdocnemis obscura*, Boisd., on sugar-cane were tested on Oahu (Hawaii) in 1937–38. They each consisted of 30 split pieces of POJ 2878 cane wrapped in clean sacking with the ends tucked in loosely to make access easy for the weevils. Ten traps were maintained in each of two untended fields of 0·59 and about 2 acres, respectively. They did not significantly reduce the weevil population, probably owing to one or more of the following causes: the migration of weevils from outside areas; the counter-attraction of cane that had been gnawed by rats or broken; or the reduced effectiveness of the Tachinid parasite [*Ceromasia sphenophori*, Villen.] in the experimental fields, which were overgrown with weeds and in which the cane lodged badly. Over 27,000 weevils were caught in the traps in slightly over a year; their numbers appeared to be higher in winter than in summer, but this was not supported by later evidence and other factors may influence their abundance. The percentage of females averaged 48 and rose to its maximum (over 57) in July. Examination of the traps at weekly intervals for five weeks showed catches of 31·0, 34·2, 20·7, 9·5 and 4·4 per cent., respectively, of the total number; of these, 55·0, 47·2, 43·9, 43·7 and 41·4 per cent. were females. The number of mature eggs varied from 0 to 17, with an average of 4·2, in females collected from September to March, and did not appear to vary with the season or with the condition of the traps.

To prevent the development of a new generation, the traps must be destroyed as soon as they no longer attract the weevils.

Pemberton (C. E.) & Williams (F. X.). **Some Insect and other Animal Pests in Hawaii not under satisfactory Biological Control.**—*Hawaii. Plant. Rec.* **42** no. 3 pp. 211–230, 121 refs. Honolulu, 1938.

Though the introduction of natural enemies has effectively controlled a number of the insect pests of agriculture that occur in Hawaii, there are many others that cause serious injury. The object of this paper is to summarise information that would be of value if their biological control were attempted. It deals with 36 pests, most of which are insects, that have few or no parasites or predators of importance in Hawaii, and gives notes on their places of origin, if known, the kind of injury they cause, and their natural enemies in the Hawaiian Islands and elsewhere.

Makino (M.). **Studies on *Chrysomphalus aonidum* L. (XIV) Parasitism of *C. aonidum* L. on *Elaeagnus* Leaf.** [*In Japanese.*]—*Kontyû* **12** no. 3 pp. 77–83, 1 fig. Tokyo, May 1938.

Chrysomphalus ficus, Ashm. (*aonidum*, auct.) is recorded as infesting the upper surface of the leaves of *Elaeagnus pungens* in Japan.

Ishii (T.). **Chalcidoid- and Proctotrypoid-wasps reared from *Dendrolimus spectabilis* Butler and *D. albolineatus* Matsumura and their Insect Parasites, with Descriptions of three New Species.**—*Kontyû* **12** no. 3 pp. 97–105, 2 figs. Tokyo, May 1938.

This paper consists of a list of all the Chalcidoid and Proctotrupoid parasites reared from *Dendrolimus spectabilis*, Btlr., and *D. albolineatus*, Mats., and from their insect parasites, and includes descriptions of three new species, *viz.*, *Eutelus tabatae*, said to be a parasite of the eggs of *D. albolineatus*, from Sakhalin, and *E. kojimae* from pupae of *D. spectabilis*, and *Calliceras kamiyae* from the cocoons of *Apanteles liparidis*, Bch., a parasite of *D. spectabilis*, both from the neighbourhood of Tokyo.

Kôno (H.) & Inouye (M.). **Die Adelgiden, schädlich an Ezofichten und Akaezofichten in Japan.** [Adelgids harmful to *Picea jezoensis* and *P. glehni* in Japan.]—*Insecta matsum.* **12** no. 4 pp. 169–173, 3 figs. Sapporo, July 1938.

Keys are given to the winged gallicolae and the galls of *Chermes* (*Adelges*) *japonicus*, Monzen, which occurs on *Picea jezoensis* and *P. sitchensis* in Honshu, Hokkaido and Sakhalin, *C.* (*A.*) *ishiharai*, Inouye, on *P. glehni*, *P. sitchensis* and *P. canadensis* in Hokkaido [*cf. R.A.E.*, A **26** 438] and *C.* (*A.*) *karafutonis*, sp. n., on *P. jezoensis*, in Sakhalin. The winged gallicola of the new species is described, and characters are given distinguishing it from those of the other two and of *C.* (*A.*) *abietis*, L., with which it is closely related. *P. jezoensis* is its primary food-plant, the secondary one being unknown.

Schaefer (E. E.). **The White Fungus Disease** (*Beauveria bassiana*) **among Red Locusts in South Africa, and some Observations on the Grey Fungus Disease** (*Empusa grylli*).—*Sci. Bull. Dep. Agric. S. Afr.* no. 160, 28 pp., 14 refs., 11 pls. Pretoria, 1936. Price 3*d.* [Recd. December 1938.]

The synonymy and distribution of *Beauveria bassiana* are discussed, and its morphological characteristics are described. It is thought that all records of *B. globulifera* on locusts in South Africa [*cf. R.A.E.*, A **23** 161] actually refer to *B. bassiana*. In 1934, during the recent invasion by *Nomadacris septemfasciata*, Serv., it was reported attacking this locust in almost all parts of the Union, and in August a whole swarm was killed by it near Lucia Bay in Zululand. Special investigations were then undertaken to study the possibility of utilising it in control.

In laboratory experiments carried out in Pretoria, in which adults and hoppers of *Nomadacris* were kept crowded in incubators at temperatures averaging 78–80°F. and atmospheric humidities of over 50 per cent., all those sprayed with spores of the fungus in water suspension were killed by it. The high mortality among controls, however, suggested that conditions in the incubators were unsuitable to *Nomadacris.* Similar results were obtained with *Locusta migratoria migratorioides,* R. & F.

In experiments between November 1934 and January 1935 in which adults of *Nomadacris* were sprayed with spores and kept in outdoor cages, the mortality, in spite of substantial rainfall, was only 17 per cent. In field experiments carried out in March–April 1935 in Pondoland, during which the average maximum and minimum temperatures were 78 and 57°F., and atmospheric humidity ranged from 65 per cent. by day to 100 per cent. by night, only 12 per cent. of *Nomadacris* confined in large enclosures and sprayed with spore suspension died as a result of infection. The spraying of hoppers in the open fields, using 25 gals. spore suspension to half an acre, had no apparent effect. It is concluded that this fungus has no effect on healthy locusts and becomes pathogenic only when their vitality is lowered by other factors, such as excessive humidity, and that the prospects of utilising it in control are very poor.

Concurrently with the above studies, observations were made in Pondoland on *Empusa grylli,* which at that time was infecting 10–20 per cent. of *Nomadacris* hoppers. The characteristic posture assumed by locusts dying from *Empusa,* and its other symptoms are described. Attempts to introduce infection by spraying with a spore suspension were unsuccessful, and 45·6 per cent. of locusts dying from *Empusa* in the field were found to be infested by Nematodes and Dipterous larvae.

It is concluded that, like *Beauveria, Empusa grylli* can only attack locusts that are in an unhealthy condition, and that the rainy weather required for epidemics to develop acts by lowering the resistance of the locusts. Attempts to cultivate *Empusa grylli* on artificial media proved unsuccessful, for they were soon overrun by other organisms, including a *Mucor* pathogenic to locusts [*cf.* **23** 278].

DU PLESSIS (C.). **Locust Outbreaks in the Union during the Season 1936–37.**—*Sci. Bull. Dep. Agric. S. Afr.* no. 181, 12 pp., 2 maps. Pretoria, 1938. Price 3*d.*

The outbreaks of *Nomadacris septemfasciata,* Serv., and *Locustana pardalina,* Wlk., in South Africa in 1936–37 are described ; there was no improvement in the general locust situation, but damage was negligible owing to successful control. The outbreak of *Nomadacris* hoppers was more extensive than in the preceding year, although heat and drought destroyed early egg deposits in Bechuanaland. In addition to spraying and dusting with sodium arsenite, poison baits, prepared by a dry mixing process, were successfully used against the hoppers. The baits contained sugar, but this was found to be unnecessary in experiments, on the basis of which 3 lb. sodium arsenite to 97 lb. maize bran was adopted as the formula for future use.

Small hopper outbreaks of *Locustana* occurred in Cape Province, but those in South-West Africa were more extensive. Poison baits gave excellent results and were used exclusively for control. The solitary phase was active, and concentrations of adults occurred in many parts of the outbreak area.

During 1937, considerable numbers of *Schistocerca gregaria*, Forsk., were found in the dry bed of the Molopo river in Bechuanaland, and in the Nabim desert in South-West Africa.

DU PLESSIS (C.). **The Influence of Weather Conditions on the incipient Swarming of the Brown Locust** *Locustana pardalina* **(Walker).**—*Sci. Bull. Dep. Agric. S. Afr.* no. 186, 51 pp., 1 map, 38 figs., 13 refs. Pretoria, 1938. Price 6*d*.

To elucidate the effect of weather on incipient swarming of *Locustana pardalina*, Wlk., in South Africa, the outbreaks of this species in a number of outbreak centres for the years 1912–37 are recapitulated and compared with rainfall statistics. The outbreak centres have an annual rainfall ranging from 5 to 20 ins., and about 90 per cent. of this amount falls during the eight months of the summer season, September–April. In analysing the effect of rainfall, only the effective precipitation, or that which totals not less than 0·25 in. and falls on one day or several consecutive days, is taken into account. Winter rainfall is not considered, as the temperatures during that season are too low for hatching. The effect of rainfall distribution in time is studied by means of bioclimatographs constructed with average monthly temperatures and effective precipitation.

Incipient swarming takes place almost annually in at least one of the outbreak centres, but large scale outbreaks occur at intervals of 3–6 years. At least one inch of effective rainfall per month and an average temperature above 52°F. are required for general hatching and rapid and successful development of hoppers. The summer temperature is always sufficiently high to start and maintain development, and does not act as a limiting factor. For development of several successive generations, the rainfall must be so distributed that not less than three out of the eight months receive at least one inch of effective rainfall. As a rule, a season permitting the development of three or four generations is favourable for incipient swarming, but six inches of effective summer rainfall appears to be the minimum for the transformation of phase *solitaria* into phase *gregaria*. The process of swarm formation extends over several seasons, and the study of bioclimatographs suggests that previous to the 1934–35 outbreak, between the seasons 1930–31 and 1933–34, *L. pardalina* passed through 10 and 13 generations in the Middleburg and Jacobsdal outbreak centres, respectively. The earlier view that incipient swarming is favoured by prolonged drought is incorrect, for the seasons of normal rainfall are eminently suitable for incipient swarming, and a dry year preceding an outbreak season will constitute a temporary check on the building up of swarms, but cannot be regarded as its cause.

To demonstrate the relation between climatic factors in the outbreak centres and the degree of infestation in the Union, these variables are expressed as indices. The climatic indices for several stations in outbreak areas are obtained by multiplying the amount of effective summer rainfall in inches by the number of months in which at least one inch of effective rainfall was recorded, and an index of 18 is considered as the threshold of incipient swarming. The seasonal locust infestation index is arrived at, largely arbitrarily, by considering the area infested, the number of bands destroyed and cost of control. The curves of the indices plotted against the seasons are then compared with one another. The correlation between the two indices is shown by statistical methods to be insignificant, suggesting that heavy outbreaks of phase *gregaria* do not necessarily coincide with high rainfall, although good rainfall favours incipient swarming. The comparison of the curves confirms the conclusions arrived at by means of the bioclimatographs, and shows that in a general way the curves of locust infestations are similar to rainfall curves in major outbreak centres.

DE MEIJERE (J. C. H.). *Polyodaspis endogena* **n. sp., eine endoparasitisch in Raupen lebende Chloropide aus Java.** [*P. endogena*, sp. n., a Chloropid endoparasitic in Caterpillars in Java.]—*Ent. Ber.* **10** no. 224 pp. 83–87, 1 fig., 10 refs. Amsterdam, 1st November 1938.

A description is given of *Polyodaspis endogena*, sp. n., which was reared from larvae of the tea leaf-roller, *Cydia* (*Laspeyresia*) *leucostoma*, Meyr., in Java. A single individual emerged from each parasitised host.

MICKLEM (T.). **Studies on Fruit Bud Formation in Deciduous Fruit Trees in South Africa. III. Some Effects of Winter Oil Sprays on Fruit Bud Formation and Leaf Bud Development in the Bon Chrêtien Pear.**—*J. Pomol.* **16** no. 3 pp. 216–223, 1 fig., 15 refs. London, September 1938.

The following is substantially the author's summary of this account of investigations on the physiological effect of winter oil sprays on pear trees of one variety in South Africa in 1935–36 [*cf. R.A.E.*, A **22** 617]: In one locality, dormant applications of 5 per cent. emulsions of raw linseed oil and a proprietary mineral oil advanced the initiation of fruit-bud formation by 2–3 weeks. Sprayed halves of trees gave a better performance than unsprayed halves in that fewer leaf-buds remained dormant, more fruit spurs were formed, shoot growth was increased, and greater leaf area and more leaves developed per fruit spur on two-year-old wood. In another locality, applications of dormant sprays of linseed oil, seal oil and mineral oil resulted in an increase both in crop and in fruit-bud formation on young and old wood.

STOREY (H. H.). **Plant Pathology. Virus Diseases of Plants.**—*Rep. E. Afr. agric. Res. Sta. Amani* **10** 1937 pp. 9–13. London, H.M.S.O., 1938.

In previous experiments at Amani [*R.A.E.*, A **22** 683], mosaic of cassava was successfully transmitted by an Aleurodid, variously determined as *Bemisia gossypiperda*, Misra & Lamba, and *B. nigeriensis*, Corbett [*cf.* **24** 637], only when whole plants were exposed. In 1937, it was found that transmission will occur only if the whiteflies feed on a very young leaf at the tip of a shoot, and if it remains alive attached to the plant for not less than about 8 days. A small change in the eco-climate of the plant might prevent an attack on such leaves and, since the Aleurodid can maintain itself on the older leaves, it is possible that a heavily infested plant may not necessarily be infected. The mosaic virus exists in severe and mild strains, both of which have been transmitted experimentally by the Aleurodid. It appears that strains indistinguishable by the symptoms they produce may have varying virulence to different varieties [*cf.* **24** 188]. Experiments have shown that naturally occurring mild strains do not confer immunity from severe strains, and attempts made to attenuate severe strains by heat-treatment, so that they might be more effective in conferring immunity, were unsuccessful.

It is almost certain that the Aleurodid is not the vector of the virus causing the brown-streak disease of cassava, and attempts to transmit it by a mealybug that occurs on cassava were unsuccessful. Though the cassava mosaic viruses are the most important economically in East Africa, the brown streak disease sometimes causes a total loss of the crop, which the mosaics never do. The disease seems to be as prevalent as mosaic in Zanzibar and the Tanganyika coastal belt ; it destroys many of the buds, and diseased cuttings often fail to produce shoots.

LOVIBOND (B.). **Investigations on the Control of Leather Jackets. (2) Notes on Craneflies and their Larvae.**—*J. Bd Greenkeep. Res.* **5** no. 16 pp. 12–17, 3 figs. Bingley, Yorks., 1937. **(3) Some Results of Breeding and Sampling Experiments during the current Season.**—*T.c.* no. 17 pp. 107–112, 1 pl., 1 ref. 1938.

These papers form part of a series [*cf. R.A.E.*, A **25** 208] dealing with investigations in England on the control of Tipulid larvae in golf greens. In the first, a study of the bionomics of *Tipula paludosa*, Mg. [**25** 612] is reviewed. Of the crane-flies caught in light-traps at Rothamsted in 1933 and 1934, 62 per cent. were *T. paludosa* and only 3 per cent. *T. oleracea*, L., and of these 23 and 77 per cent. were females ; in 1934, trapped females of *T. paludosa* had already laid 95 per cent. of their eggs. The rapidity with which the emulsion of orthodichlorobenzene [*cf.* **25** 208] brings the larvae out of the soil suggests that their normal position is close to the surface ; in experiments with larvae placed in pots of soil, the action of the liquid appeared to decrease below a depth of 1 inch, although it penetrated further.

In experiments described in the second paper, larvae collected from many localities in the British Isles were reared and the adults were kept and paired in the way already noticed [**25** 612]. For the rearing of larvae of known parentage, paired females were caged over the pots of germinating wheat ; they invariably deposited all their eggs. Most of the adults that emerged from the original larvae were identified as *T. paludosa* or *T. oleracea*, the former predominating, but many of the larvae had probably escaped from the pots or failed to survive. Some of them were parasitised by larvae of *Bucentes geniculata*, DeG. [*cf.* **8** 523]. The eggs of *T. paludosa* were deposited in groups, and those of *T. oleracea* and *T. vernalis*, Mg., singly or in pairs, below the surface of the soil. The maximum numbers of eggs per female developed by females of *T. oleracea* caught in light traps and those reared were 1,074 and 461, respectively, with an average of

378 for the latter ; they hatched in 7 days, 90 per cent. being viable. Eggs of *T. vernalis* hatched in just over three months. Experimental evidence is given of the lateral movements of crane-fly larvae in turf.

Entomological Research Station, Warburton, Cheshire. Report for the Year 1937.—*J. Lancs. agric. Soc.* 1938 repr. 31 pp., 8 figs., 36 refs. Preston, 1938.

This report comprises four papers by H. W. Miles and M. Cohen on the injury caused to farm crops by wireworms and on their bionomics, ecology and control, including the results of preliminary investigations in 1937 on an experimental three-acre field at Warburton (Cheshire), a paper by R. Stewart on the soil (light sandy loam) of the experimental field, and a survey from the literature of injury by wireworms to farm crops in Britain during the last 150 years by Miles, who shows that injury was greatest when extensive areas of grassland were broken up for arable cultivation.

Wireworms injure young potato plants in the spring and early summer, particularly in dry cold seasons, but the new tubers are not usually attacked until August or September. The attack is continued in infested potatoes in clamps ; in February, wireworms were numerous in the soil beneath and around small clamps that were investigated. Injury to cereals is greatest in spring, but may be considerable to seed and seedlings in late autumn and in mild periods throughout the winter. It is generally less severe in the case of spring-sown cereals, owing to the shorter period of exposure to attack. The plant dies if severely injured at the base, but new tillers are formed if the attack occurs higher up and the main shoot is killed. On the experimental field, wireworms began tunnelling into the main roots and " bulbs " of swedes in August, and into the sides of the tap roots of sugar-beet seedlings in late July. The beet was not severely injured, in spite of a population of about 300,000 wireworms per acre. Cabbage, cauliflower and carrots all suffered more or less serious injury, but the degree of its severity was obscured owing to infestation by other pests.

Observations on the life-history of *Agriotes obscurus*, L., which is the most important species in Britain, showed that the adults were not active and commonly occurred under refuse ; they fed on leaves of wheat and oats without causing appreciable injury. Dissected females contained 20–100 eggs. Land under grass, and weedy and waste land appear to be suitable for oviposition. Pupae occurred from 1 to 10 ins. below the surface of the soil, but were most numerous in the top 4 ins. The pupal stage lasted nearly a month. Newly emerged adults usually remained in the soil during the winter ; they were found in soil samples from August to March. Other species of wireworms that occasionally occur in agricultural land in north-western England are *Athous obscurus*, Payk. (*haemorrhoidalis*, F.), *Hypnoidus* (*Cryptohypnus*) *riparius*, F., and possibly *Agriotes lineatus*, L., adults of which have been taken there.

In general, wireworms were most numerous in the upper 3-in. layer of soil in April and September, downward migration had begun by mid-May, and at the end of June most occurred at 6–10 ins. [*cf. R.A.E.*, A **15** 651]. During the winter of 1937–38, they were commonest at a depth of 9–10 ins., and the upward movement began in mid-March. Investigations in several localities in Lancashire and Cheshire showed that when the wireworm population exceeded

200,000 per acre, considerable injury was caused to potatoes [*cf.* **12** 128]. Non-humified organic matter in the soil provides an alternative food for the larvae, and crops on newly ploughed grassland are less severely attacked. Injury increases, however, as the turf disintegrates. This suggests that the amount of non-humified matter in the soil should be supplemented by adding manure or ploughing in green crops.

Previous attempts to control wireworms, particularly by soil treatment with naphthalene, which has both a toxic and a repellent effect on them, and by using baits to protect crops, are briefly summarised. In experiments in 1937, naphthalene had no effect on the foliage, vigour or yield of potatoes when applied at the rate of 3 cwt. per acre before the land was ridged up, but did not appreciably reduce injury. The growth was also unaffected by dressings of 1½–6 cwt. per acre applied in the drills so that the sets were in contact with it. The percentage germination of wheat seed planted in October was reduced very severely by mixing it with naphthalene at the rate of 16 lb. per bushel and, less markedly, with superphosphate at the rate of 32 lb. or more per bushel. After a week, 4 per cent. of untreated seedlings were destroyed, whereas less than 1 per cent. of those treated were injured. Spring infestation of cabbages and strawberry plants set out in the preceding autumn was reduced by two-fifths and two-thirds, respectively, by intersowing wheat between the rows [*cf.* **26** 462].

The yield of one variety of potato did not increase after mid-September, but injury by wireworms increased up to the end of October. Potatoes should therefore be lifted as early as possible, and this is facilitated by the substitution of mid-season varieties, or spraying with sulphuric acid in late September to kill the tops of main crop potatoes. Applications of quick-acting nitrogenous fertilisers should be made to autumn-sown cereals in late February and early March to stimulate growth and tillering. Oats or spring wheat should be drilled where large bare patches have been caused. The wireworms should be exposed to attack by birds by cultivating infested land in autumn after the removal of the crop and in spring before seeding or cropping. Skim ploughing of stubbles, followed by frequent cultivation and harrowing, should be carried out as soon as possible after harvest.

DOTTI (F.). **L'infuso di legno quassio nella lotta contro le** *Hoplocampa* **del susino.** [Infusion of Quassia in Work against Plum Sawflies, *Hoplocampa* spp.]—*Riv. Fruttic.* **1** no. 2 repr. 31 pp., 9 refs. Pistoia, April 1937. [Recd. December 1938.]

In the spring of 1936, experiments were made in northern Italy to compare the value against the plum sawflies, *Hoplocampa minuta*, Christ, and *H. flava*, L., of infusions of 1·5 or 2 per cent. quassia (obtained by soaking the chips in water for 48 hours and then straining) with 0·3 or 0·4 per cent. lead arsenate [*cf.* *R.A.E.*, A **25** 465]. Applications were made about 23rd March, when the plums were in full blossom, about 31st March, when nearly all the petals had fallen, and 18 days later, when the calyces had fallen [*cf.* **26** 5].

The results were estimated from the percentages of fruits infested on sprayed and control trees on 20th–25th April and, in two instances, 20 days later. The average percentages were 1·76 for trees sprayed with quassia, 5·54 for those sprayed with lead arsenate, and 13·16 for the controls. The stronger quassia spray appeared to be only slightly more effective than the weaker.

Quassia appeared equally effective against the Aphid, *Hyalopterus arundinis*, F., but was inferior to lead arsenate against *Hyponomeuta padellus*, L. It did not scorch the leaves or poison bees.

BUA (G.). **Serie di esperimenti con sostanze attrattive per la mosca delle olive.** [Series of Experiments with Substances attractive to the Olive Fly.]—*L'Olivicoltore* **15** no. 5 repr. 19 pp. Rome, May 1938.

In continuation of work in Italy on substances attractive to the olive fly, *Dacus oleae*, Gmel. [*cf. R.A.E.*, A **22** 365], further experiments, which are described in detail, were carried out in 1934 and 1935. In 1934, the pans were baited with ammonium salts, several types, including new ones, of the molasses preparations called Dachicida and Dacivoro [**21** 440, etc.], combinations of these and ammonium salts, Clensel, cinnamon oil, and infusions of bran and of dried figs, both with the addition of borax. Of these, the most attractive was a 10 per cent. dilution of Dachicida P, a new preparation of molasses containing 2·5, 3·5, 1 and 0·5 per cent., respectively, sodium arsenite, water, olive oil and ammonium sulphate. It lost its attractiveness, however, almost completely after a few days. Dachicida P was tested only in September, October and November, and during the late spring and summer, when the infestation by *D. oleae* was in its early stages, 5 or 10 per cent. dilutions of ammonium nitrate were more attractive to the fly than any of the other baits. Clensel, which is known to attract *Ceratitis capitata*, Wied., also showed good attractive power ; it was used at a dilution of 3·3 per cent. and came second in order of efficiency in September–November.

In 1935, the highest catches for the period from late April to the end of September were obtained with 3 per cent. dilutions of ammonium nitrate or diammonium phosphate, while Dachicida P was not even the best of the molasses baits. In October and November, however, Dachicida P gave the highest catches. Considerable variation was observed between the results given by the preparations of molasses in the two years. This is attributed to variations in composition. Their inferiority to the ammonium salts in summer was probably due to fermentation at high temperatures, particularly as Dachicida P was found to retain its attractiveness longer if borax or potassium metabisulphite was added to reduce fermentation.

As a general result of his tests, the author suggests that the use of baits should be begun in May, and that pans baited with ammonium salts should be employed throughout the summer at the rate of 1 to 3–4 trees. These baits also catch the olive moth, *Prays oleellus*, F.

JANISCH (E.). **Untersuchungen über den Massenwechsel von Schadinsekten.** [Investigations on the Variation in Abundance of Insect Pests.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 435–448, 6 figs. Stuttgart, 1938.

The author discusses problems connected with the variation in abundance of insect pests of forests in Germany. The use of large quantities of insecticides while an outbreak is in progress can only be regarded as a substitute for its destruction in its early stages and for methods of increasing the effectiveness of the factors causing an outbreak to collapse naturally. Methods of forecasting the probable degree of infestation have hitherto been largely based on numerical counts, but numbers alone cannot be responsible for an outbreak, since a considerable rise in population in one year has not always been followed by an outbreak in the following year. The explanation of this phenomenon is considered to lie in the physiological condition of the insects, and this should in every case be tested in respect to their resistance to environmental and nutritional conditions that vary from the optimum [*cf. R.A.E.*, A **24** 623; 26 336]. Examples are given of work on the reaction to environmental conditions of various pests, chiefly *Lymantria monacha*, L., for the larvae of which recent investigations have shown the developmental and vital optima to be 21·5°C. [70·7°F.].

SPEYER (W.). **Beiträge zur Biologie des Kleinen Frostspanners** (*Cheimatobia brumata* **L.**). **Das Ausschlüpfen der Raupen und der Flug der Falter unter Berücksichtigung innerer und äusserer Faktoren.** [Contributions to the Biology of the Lesser Winter Moth, *Operophtera brumata*, L. The Hatching of the Larvae and the Flight of the Adults in Relation to internal and external Factors.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 449–471, 7 figs., 14 refs. Stuttgart, 1938.

The following is based on the author's summary of further observations on the biology of *Operophtera* (*Cheimatobia*) *brumata*, L., in Germany [*cf. R.A.E.*, A **26** 420, 716]: The relation between the dates of oviposition and hatching in eggs deposited by different females and their progeny was clear, although the eggs did not always hatch in the order in which they were deposited. The character of hatching early or late was inherited, and although it has been shown that the winter diapause in the egg lasts only a fortnight, in some races eggs subjected to warmth hatched early, while in others eggs kept under identical conditions hatched late.

The males begin to fly about 25 minutes after sunset, without regard to weather or environment, and all are active after about half an hour. Male emergence reaches its maximum about 10 a.m. and its minimum about 3 p.m. Females never emerge early in the morning or late at night. The number of emerging females increases slowly from 8 a.m. to 3 p.m., then rapidly up to 7 p.m., and then decreases slowly. The males are more active at high temperatures than at low ones, but are still fairly active at 0·7°C. [33·26°F.]. Exposure to a temperature of −8·9°C. [15·98°F.] did not influence adult longevity, but decreased the numbers of fertilised and deposited eggs. Adults did not survive exposure to −20°C. [−4°F.]. Light rain does not disturb the adults, and calm weather or slight wind favours flight, but strong gusts hinder it. There was no noticeable effect of temperature and air pressure on adult emergence.

BÖRNER (C.). *Cryptomyzus korschelti* **n. sp., die Blasenlaus der Alpenjohannisbeere.** [*C. korschelti*, sp. n., the Blister-gall Aphid of Alpine Currant.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 472–480, 6 figs., 13 refs. Stuttgart, 1938.

The author describes characters distinguishing *Capitophorus*, *sens. strict.*, *Cryptomyzus*, and *Myzella*; he now considers that the last two are both valid genera, *Myzella* having some characters of *Capitophorus* and some of *Cryptomyzus*. He has found that an Aphid causing blister-galls on Alpine currant (*Ribes alpinum*) in Germany, which he had regarded as *Capitophorus* (*Cryptomyzus*) *ribis*, L., is distinct, and names it *C.* (*C.*) *korschelti*, sp. n., giving characters differentiating the fundatrices and winged and wingless parthenogenetic females of the two species. *C. korschelti* occasionally occurs on black currant, but not on red currant.

BRAMSTEDT (F.). **Der Nachweis der Blutlausunanfälligkeit der Apfelsorten auf histologische Grundlage.** [The Proof on a histological Basis of the Non-susceptibility of Varieties of Apple to Infestation by the Woolly Apple Aphis.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 480–488, 8 figs., 14 refs. Stuttgart, 1938.

Characteristic changes in the tissues of apple seedlings immune, resistant, or susceptible to infestation by *Eriosoma lanigerum*, Hsm., are described in detail ; in every case they provide a definite indication of the class to which a variety belongs.

BLUNCK (H.). **Feinde und Krankheiten der Maikäfer.** [Enemies and Diseases of May Beetles.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 488–507, 9 figs., 8 pp. refs. Stuttgart, 1938.

In connection with his survey of measures against *Melolontha* spp. [*R.A.E.*, A **26** 520, etc.], the author reviews from the literature and his own observations the natural enemies of the adult beetles. They include mammals, birds, predacious Carabids, ants, parasitic worms, fungi and bacteria. The degree of control exercised by them is less than that afforded by natural enemies of the larvae.

ABRAHAM (R.). **Mermithiden als Parasiten des Kartoffelkäfers** (*Leptinotarsa decemlineata* **Say**). [Mermithids as Parasites of the Potato Beetle.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 507–513, 5 figs., 3 refs. Stuttgart, 1938.

Details are given of an infestation of *Leptinotarsa decemlineata*, Say, in Baden in 1937 by Mermithids of the genus *Hexamermis*, which were found in 13 of 19 larvae, 7 of 19 pupae and 10 of 31 adults, all from one potato field. The parasitised larvae and pupae showed enlargement of the abdomen. The fat-body of the adults was normal or nearly so, but the ovaries and testes were atrophied. As local insects were not parasitised, it is suggested that the chief host may have been the slug, *Limax agrestis*, which is common in the district.

TRAPPMANN (W.). **Ueber Giftwirkung und Gifte im Pflanzenschutz.** [On Poisoning and Poisons in Plant Protection Work.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 514–538, 3 pp. refs. Stuttgart, 1938.

Sections of this survey of the literature on the use of poisons against plant pests deal with the physiology of the living cell, the ways in which it is injured by the physico-chemical and chemical action of poisons, their toxic action on a living organism and the modes of action of insecticides and fungicides.

PRELL (H.). **Die Organisation des forstlichen Meldedienstes in Sachsen.** [The Organisation of the Forest Report Service in Saxony.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 539–550. Stuttgart, 1938.

This is an account of the service organised in Saxony for reporting the occurrence in forests of injurious insects, rodents and fungi. A list of the principal pests against which the work is directed includes 14 species or groups of species of insects.

FREUDENSTEIN (K.). **Pflanzenschutz und Bienenzucht.** [Plant Protection and Bee-keeping.]—*Z. PflKrankh.* **48** pt. 9–11 pp. 550–563, 10 refs. Stuttgart, 1938.

The author discusses in some detail the danger of poisoning bees as a result of the use of insecticides (particularly arsenicals) and certain fungicides [*cf. R.A.E.*, A **25** 211], and the ways in which spraying practices in orchards in Germany can be modified to minimise it.

BÖTTCHER (F. K.). **Untersuchungen über den Einfluss von Pflanzenschutzmitteln auf die Bienen. II. Teil. Die Wirkung des Nicotins auf die Bienen.** [Investigations on the Effect on Bees of Materials used in Plant Protection Work. Part II. The Action of Nicotine on Bees.]—*Gartenbauwiss.* **12** pt. 2 pp. 234–262, 8 figs., 10 refs. Berlin, 1938.

The following is based on the author's summary of laboratory investigations on the effect on honey bees of nicotine and nicotine sulphate as used in the control of insect pests : Solutions of nicotine and nicotine sulphate were weak intestinal poisons, but their repellent action prevented accurate determination of lethal doses. Nicotine was an active contact poison, more toxic at 34·5°C. [94·1°F.] than at 20°C. [68°F.], and the addition of a wetter increased its toxicity. At the concentrations of 0·1–0·5 per cent. that are used in practice, the maximum mortality was 40–60 per cent. under laboratory conditions that were especially favourable to poisoning. Complete mortality of bees therefore cannot occur in practice. Nicotine sulphate had only a weak action as a contact poison, giving only 75 per cent. mortality when undiluted. Nicotine, and to a less degree nicotine sulphate, acted also as respiratory poisons, but their effect could not be gauged apart from their action by contact. Nicotine sprays usually lost their toxic effect on drying, and nicotine dusts within 24 hours of application. The results of the laboratory work were confirmed in the field, and it is therefore concluded that nicotine sprays and dusts at the customary strengths do not cause any serious harm to bees.

KEMPER (H.). **Hausschädlinge als Bewohner von Vogelnestern.** [House Pests as Inhabitants of Birds' Nests.]—*Z. hyg. Zool.* **30** pts. 7–8, 9, 10 pp. 227–236, 269–274, 291–297, 1 fig., 2 pp. refs. Berlin 1938.

The author gives lists of the numerous Arthropods found in birds' nests, based on investigations by himself in Germany and records from various countries in the literature. From the data obtained and a discussion of the literature on the subject, he concludes that birds' nests are of little or no importance as sources of infestation by pests troublesome in houses.

LAUE (G.). **Phosphorwasserstoff bei der Giftgetreideherstellung.** [Hydrogen Phosphide Gas produced in the Preparation of poisoned Grain.]—*Z. hyg. Zool.* **30** pt. 10 pp. 300–301. Berlin, 1938.

The use of hydrogen phosphide as a fumigant is subject in Germany to regulations that do not apply to baits of grain poisoned with phosphides [*cf. R.A.E.*, A **24** 476], because normally no hydrogen phosphide gas is produced prior to ingestion. It is produced, however, when such baits are made by mixing proprietary preparations of phosphides with grain that has been moistened with aqueous solutions of glue and sugar or milk and sugar, as phosphides always generate it on contact with water. Experiments are described that show that when 2·5–3 per cent. of phosphide is added to 50 kg. grain, from 2 to 3 mg. hydrogen phosphide is generated, a considerable amount, as, apart from the risk of fire, 0·01 mg. per litre can prove lethal after six hours.

REICHMUTH (W.). **Die Schadwirkungen der Flechtlinge (Copeognatha) unter Berücksichtigung der Entwicklung und ihrer Abhängigkeit von Feuchtigkeit und Temperatur.** [The Harmfulness of Psocids, with Notes on their Development and their Dependence on Moisture and Temperature.]—*Mitt. Ges. Vorratsschutz* **14** no. 5 pp. 57–63, 6 refs. Berlin, September 1938.

Notes, largely based on a paper by Peus [*R.A.E.*, A **21** 532], are given on infestation of houses in Germany by Psocids and their control by dry heat or fumigation. They occasionally damage papers and foodstuffs, but only when present in very large numbers.

STELLWAAG (F.). **Toxikologische Probleme in der Schädlingsbekämpfung.** [Toxicological Problems in Pest Control.]—*Angew. Chemie* **51** no. 35 pp. 589–594, 22 refs. Berlin, 1938.

In this paper for industrial chemists, the author discusses the various methods that have been adopted in calculating the toxicity of insecticides, the problem of finding satisfactory substitutes for existing poisons that are undesirable for various reasons, the ways in which insecticides injure plants, and the desirability of co-operation between chemists and biologists in studying the toxicology of insecticides and fungicides.

STELLWAAG (F.). **Vorläufige Mitteilung über Versuche zur chemischen Winterbekämpfung der Traubenwickler.** [Preliminary Communication on Experiments regarding chemical Winter Control of the Vine Moths.]—*Wein u. Rebe* **20** no. 7 repr. 8 pp., 12 refs. Mainz, 1938.

No effective substitute has so far been found for arsenicals against the larvae of *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., which are serious pests of vines in Germany. The control of infestation by measures against adults or pupae would require the co-operation of all the growers in a district, whereas larval control is effective in individual vineyards.

The author found that a winter spray of chlorinated hydrocarbons at 4 per cent. strength killed the pupae in their webs, but as injury to the vines was apparent at 5 per cent. strength, the margin of safety is too narrow for the treatment to be recommended. Mineral oil emulsions of high viscosity, such as are used on fruit trees in winter in England and the United States, also injured the vine, though when tested, emulsions containing 4–7 per cent. of such oils killed the pupae. Investigations were therefore carried out to discover an oil of low viscosity, but of equal toxic effect, containing components harmless to the vines. Such an oil should volatilise within 24 hours, thus avoiding the danger of secondary injury by frost and permitting the use of preparations containing sulphur, and should have a boiling point below 250°C. Care was taken in the choice of an emulsifier, as the amount of oil reaching the insects increases with the wetting power and instability of the emulsion. It has been stated that effectiveness is inversely proportional to the amount of emulsifier [*R.A.E.*, A **20** 688].

The author tested a number of oils, the composition of which is not specified, in the laboratory. One had particularly good wetting power, and pupae dipped in 4 and 5 per cent. emulsions died in 30 seconds. The volatile oils flow through the stigmata into the tracheae. Emulsions containing 2–10 per cent. oil caused no injury to vines, either with or without foliage.

It was subsequently sought to reduce the amount of oil and to use oils of German origin. As volatile oils penetrate the tracheae by capillarity, tests were made on their use as carriers for protoplasm and nerve poisons. Suitable 2 per cent. oil emulsions combined with 0·2 per cent. nicotine gave a pupal mortality of 100 per cent. in 15 seconds. Other contact poisons and also aniline and nitrobenzene were equally effective. As the action of the oils is purely physical, these experiments were continued with refined, odourless synthetic oils of German origin, and a suitable emulsifier. Laboratory tests with summer pupae then gave satisfactory results and the vine leaves were not injured.

The mixtures of contact poison and oil emulsion were also effective against larvae of *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., hibernating under the bark, overwintering larvae of *Lecanium corni*, Bch., and *Pulvinaria betulae*, L., and larvae of *Tetranychus*.

PAPERS NOTICED BY TITLE ONLY.

GOUX (L.). **Notes sur les Coccides (Hem.) de la France (22e note). Description de deux Pseudococcines nouvelles.**—*Bull. Soc. zool. Fr.* **62** no. 7 pp. 451–458, 11 figs., 5 refs. Paris, 12th February 1938.

TAKAHASHI (R.). **Some Coccidae from Formosa and Japan (Homoptera) III** [*Kuwanaspis arundinariae*, sp. n., on *Arundinaria* sp., in Formosa].—*Mushi* **11** no. 1 pp. 42–45, 3 figs. Fukuoka, March 1938.

SIRAIWA (H.). **Descriptions of two new Coccids from Japan** [*Trionymus mori*, sp. n., and *T. soja*, sp. n., from roots of mulberry and soy bean, respectively].—*Kontyû* **12** no. 3 pp. 106–110, 2 pls., 1 fig. Tokyo, May 1938.

SHINJI (O.). **A new** *Myzus* [*M. polygoni-yonai*, on *Polygonum*] **from north-eastern Japan.**—*Zool. Mag.* **50** no. 2 pp. 108–110. Tokyo, February 1938.

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